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IN THE  
CAUSATION OF DISEASE  
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the correction. He is a  
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highness of the <sup>possible</sup> by us jointly  
Appreciating thine  
Grace Fletcher

## THE RÔLE OF MODERN DIETETICS

IN

## THE CAUSATION OF DISEASE

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THE RÔLE OF  
MODERN DIETETICS  
IN  
THE CAUSATION OF DISEASE

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1905

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## P R E F A C E.

THIS book is a collection of essays which appeared originally in the *British Medical Journal*, the *Lancet*, the *Medical Press*, the *British Dental Journal*, and the *British Journal of Dental Science*. Some now appear for the first time, and it is to be hoped they may constitute a fairly coherent whole. I am indebted to my wife, not only for many corrections from a literary point of view, but also for putting the principles which I advocate into practice with the most excellent results. I am also indebted to my friend, Dr. W. G. Creswell, for several corrections and suggestions. His important work on avian pathology and on the feeding of birds, which from a biological standpoint runs somewhat parallel to my own, and his large experience as a medical practitioner, have led me to consult him on points upon which I had imperfect information.

J. SIM WALLACE.

30A, WIMPOLE STREET,  
CAVENDISH SQUARE.  
*April, 1905.*



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“If physicians could be got to realize the importance of providing the jaws, teeth, and the muscular coats of the digestive tract with adequate work, an untold amount of disease and suffering would be averted.”

HARRY CAMPBELL, M.D., F.R.C.P.  
(*Lancet*, December 24, 1904).

## INTRODUCTION.

SEVERAL years ago my attention was directed to the subject of dietetics while investigating the causes of dental caries. At that time hereditary, constitutional and developmental considerations were generally held to be responsible for the prevalence of the disease. I became convinced, however, that these factors were practically negligible, while certain dietetic errors were to all intents and purposes responsible.

The dietetic factor—from the point of view which I considered important—had scarcely been considered, and therefore it specially engaged my attention. It became evident, however, that if any substantial amelioration of the dietetic conditions was to be made, it would be necessary to appeal to physicians and parents, and to be able to show that the advantage which I claimed would accrue to the teeth from the proposed change would not be antagonistic to the welfare of the body in general. On further investigation it became evident that the havoc played among the teeth was only a local manifestation of other more general and equally serious troubles resulting from the same dietetic errors.

Unfortunately general useful knowledge is so carefully

## INTRODUCTION

excluded from the education of those who become parents, that the homely and important subjects of diet and disease seem to them abstruse topics written by specialists in an unknown language. These essays are therefore only addressed to the members of the medical profession and those who are conversant with the principles of biology. At the same time it is to be hoped that the subject matter may soon reach intelligent parents, for the ultimate object of this work is the prevention of disease, and this should be as much the concern of parents as of medical practitioners.

## CHAPTER I.

### THE CAUSATION OF DISEASE.

It is unusual except in philosophical writings to attempt to form any distinct idea of what we mean when we use the word cause. Generally, however, the word is used with accuracy, and it is only on account of the occasional abuse of the word that it is necessary to mention the meaning which it properly has, and to recognise more especially the significance of the word as it will be used in what is to follow. Philosophically speaking, the cause “is the sum total of the conditions, positive and negative taken together, the whole of the contingencies of every description, which, being realized, the consequent invariably follows.”\* Fortunately, however, common usage spares us contemplating such an array of conditions; and, thanks to common-sense, we purposely select only one or two as the cause or causes, while we regard the rest merely as conditions which need not be mentioned.

A source of much confusion is done away with by recognising that the antecedent to which we assign the name “cause” depends upon what we are concerned with. Thus, for example, in ordinary parlance the cause of a disease is that antecedent which, if it had been prevented,

\* J. S. Mill, “A System of Logic.”

the disease would not have occurred. A surgeon contemplating the cure of septic poisoning by the removal of an abscess may quite correctly say that the cause of the trouble was the abscess. Then again, the pathologist might equally correctly say that the cause was certain septic micro-organisms; while the patient might say that the cause was a severe blow and a weak state of health at the time.

Sometimes the cause, from two or more points of view, may be the same; thus, for example, whether we have in mind the prevention or treatment of consumption, we may speak of lack of fresh air as the cause, for this is the antecedent which it is a prime necessity to recognise in either case.

The cause of a disease may or may not be the immediate antecedent, and whether the immediate antecedent shall be designated the cause, depends on whether it is the antecedent which may be remediable or advisedly altered. When remediable it is unnecessary to pursue its antecedents further; where, however, it is not, we must find a prior antecedent which is remediable, even though this is complex and requires to have its connection with the immediate cause explained. As an example of this we may refer to the cause of dental caries. When the pathology of this disease was elucidated it was found that the invariable and necessary antecedent was acid fermentation, or acids and micro-organisms. It was quite natural to consider that this was the cause, and having done so, to advocate the use of antiseptics and alkaline mouth-washes, for by this means it was expected to prevent the disease. As, how-

ever, it has been found that the effect of these antiseptics and antacids has been quite unsatisfactory as means of preventing the disease, the cause has been sought in a prior antecedent, that is to say, in some dietetic error, which if rectified, the disease does not take place. Now we recognise the cause of dental caries to be that the natural food-stuffs are to a large extent deprived of their accompanying fibrous parts, and prepared and consumed in a manner which renders them—especially the carbohydrates—liable to lodge and undergo acid fermentation in the mouth.

A somewhat perplexing circumstance is brought to light in investigating the causation of disease, for it so happens that the antecedent which we wish to avert may be an absence of some particular condition. Thus, for example, we are justified in saying that lack of the proper nutritive constituents in the food causes certain deviations from a normal state of health, and certainly a case of starvation will justify us in saying that lack of food is the cause of the condition. This is confusing, since the cause is generally supposed to be a positive agent. I emphasize this, as it so very frequently happens that diseases do arise from *lack* of the normal conditions which should obtain.

Another source of complexity is to be observed in the peculiar and variable reaction of the patient. We speak of susceptibility and immunity to disease, but this resolves itself into a recognition of a counteracting condition, which, when sufficiently powerful, the disease does not take place. Susceptibility and immunity are properly recognised as causes when considering the etiology of disease,

though they are rather to be looked upon as links in the chain of causation than as actual causes themselves. Thus, for example, exhaustion brings on a state of transient susceptibility, and disease may supervene. We rightly and usefully refer to the exhaustion as having been a cause of the disease by rendering the patient susceptible, or more generally it may be said that antecedents which give rise to a condition of susceptibility, whether transitory, permanent, or hereditary, are rightly and usefully called causes of disease. It is, however, a futile pretence at elucidating causation to say that heredity itself is a cause, for it is merely a condition as constant as obvious, and as well recognised as the necessary existence of the patient. It is possible that the exact environmental conditions which give rise to the hereditary peculiarities may be discovered, and then we shall be able to regard such as causes of disease, or at least of susceptibility and immunity, for such antecedents may conceivably be preventable. In the meantime, however, it is desirable to refer to those conditions which to a certain extent are known to have given rise to varying degrees of immunity in different people and individuals, for the provisional knowledge which is derived from a reference to these is at least suggestive. Some races have become immune to certain diseases on account of a more rigid extermination of those who were susceptible; thus, for example, we know that Negroes living in malarious regions are much less susceptible to malaria than Europeans, while, on the other hand, Europeans are much less susceptible to tuberculosis than Negroes. Other somewhat similar considerations may be

mentioned. Certain individuals or families are more susceptible to troubles caused by cold and damp. As man in primitive times was an animal living almost entirely in tropical regions, a cold and damp environment is one to which he has only recently become adapted. Bearing this in mind, and recognising that the most recently established characters are the most unstable, it can hardly surprise us that considerable fluctuations in the degree of immunity to such troubles should commonly present themselves.

Correlated to this we may mention variations in susceptibility to certain diseases on account of recently acquired habits corresponding to which the hereditary organization has as yet hardly become thoroughly adapted. Many instances of this may be found in a consideration of those diseases which are influenced by the upright posture. A simple example may be observed in varicose veins. This is obviously and directly related to the upright posture and the habits of the patient. Some diseases may, however, have the upright posture as an indirect and secondary antecedent. This will be found to be so in the most unsuspected cases. To me this idea has proved a most useful guide in forming provisional hypotheses, and I have recorded some cases in my own special department where it is obviously beneficial to recognise it as a cause both in prevention and treatment. Here, however, I would record my conviction that "neurasthenia" is in part a result of the upright posture, and I believe a recognition of this in the future will be of considerable service.

A correlated idea which occasionally proves to be of

value in discovering the cause of disease is the fact that the development of the individual recapitulates the evolution of the species, and that the environment suitable for an individual at any one period may be surmised by a consideration of the environment which his ancestry has been subjected to for prolonged ages in its remote history, even although the immediate predecessors for many generations may not have been influenced by such environment. I do not know that I can give an unequivocal example of this, but possibly the benefit which is so often derived from giving young children fresh fruit and vegetable juices may be taken as showing a still inherited relic of our arboreal and frugivorous existence before the advent of man. A recognition of this principle, together with other considerations, led me to believe that acid fruits would not be harmful to the teeth, especially of young children, and practical experience and clinical evidence proves this hypothesis to be correct.\*

Now, notwithstanding our general recognition of the significance of differences in susceptibility and immunity, we recognise that these variations are not important in dealing with the prevention of disease. This is admitted, and there is a general recognition of the fact that as marriage is continually producing a regression towards mediocrity, we must presume the essential homogeneity of the hereditary constitution, unless we have very special evidence of the contrary. Moreover, whether predisposed

\* I am, of course, aware that students are still taught that all foods which are acid in themselves should be avoided.—Smale and Colyer, "Diseases and Injuries of the Teeth," p. 279.

to disease or not, identical methods and precautions are necessary to prevent it.

A survey of the above leads us to conclude that, in general, disease is caused by imposing environmental conditions upon the individual differing from those which obtained during the evolution of the species; while disease is prevented by maintaining the essential similarity of the environment to that which obtained during the evolution of the species. This simple, obvious, important, and useful generalization is very frequently overlooked, and by modern writers on dietetics is completely ignored.

## CHAPTER II.

### INCREASE AND DECREASE OF DISEASE.

IN a general survey of the progress of medicine one of the most pleasant features is the decreased prevalence of most diseases. This and the kindred consideration of the decreasing mortality is often referred to with a certain amount of pride by the medical profession. On the other hand the increased prevalence of certain diseases is generally overlooked, or mentioned together with some more or less plausible argument or statement, which mitigates the painful impression which otherwise might be conveyed by a consideration of the lamentable fact. Probably it would be productive of more good to make an open and unqualified admission that there has been an increase in those diseases which statistics appear to prove pretty conclusively have increased. The general decrease of disease is by no means sufficiently marked to warrant us in supposing that all diseases must have decreased in frequency. The marked and undeniable increase of some diseases precludes any such conclusions.

We may mention a few diseases which have increased in frequency. The diseases and irregularities of the teeth, adenoids, appendicitis, neurasthenia associated with gastric

insufficiency, infantile diarrhoea, "indigestion," anaemia, rickets, internal cancer in men, and insanity.

It may be noted in passing that all these diseases are more or less directly associated with digestion or the digestive tract, and how they result from the modern practices and theories of dietetics will be suggested in the following chapters.

References to the diseases of the teeth, however, will be almost wholly omitted, as I have already dealt with these in separate works. It will of course be readily understood that though reference is not made to the diseases of the teeth their importance is not to be overlooked.

The effects of erroneous restrictions in diet are most readily shown in the mouth, for it is easily inspected, and indeed it was a study of the pathology of the teeth and the conditions which brought about their diseases, which gave me the key to the dietetic errors which are responsible for the increase of the diseases we have just referred to.

Nor will any full reference be made to those diseases which are already more or less fully recognised to be the result of dietetic errors. Thus it is not necessary to refer to the relationship between insanity and malnutrition. It is admitted that the development of the brain no less than the development of the body is dependent on healthy nutrition.

If we can show that there is increased malnutrition of children and mothers we shall show a cause of the increase of insanity.

We may now refer to some typical examples of the most important and at one time common diseases which have

decreased in frequency. Typhus fever, relapsing fever, rabies and small-pox have almost vanished from the country, while the ravages of tuberculous diseases have been largely curtailed. It may be noted that these are diseases depending largely for their propagation on foul air, infection, and insanitary surroundings. That a certain group of diseases connected with the digestive tract should have increased, while those depending on sanitary surroundings should have decreased, is noteworthy, for insanitary surroundings certainly cannot be beneficial to the digestive tract, nor can an impaired alimentary tract be anything but conducive to the inception of diseases primarily dependent upon insanitary surroundings. Indeed it is admitted that neurasthenic patients, for example, are predisposed to tubercle and typhoid fever. I believe these are not only striking but also suggestive facts, and a consideration of the principles of the causation of disease will show why we can expect a rapid decrease of these diseases as soon as the cause of the increase is discovered and generally appreciated.

It is well known that disease is the result of surroundings which are inimical to the inherent nature of the individual, while health is the result of the continuous harmony of the individual with his environment. In the course of countless ages man became hereditarily adapted to the environment to which he was continuously subjected, and any change in the surroundings is almost certain to bring a train of diseases which continue till the organism becomes adapted to the new environment or until the environment returns to what it originally was. The

diseases which have hitherto been decreasing were so obviously the result of the surroundings which man brought upon himself, that it is hardly necessary to refer to the fact. The close, ill-ventilated houses, the over-crowding and the accumulation of insanitary matter seldom occurred or spread before the building of houses, and more especially before the close congregation of people in towns. However, as soon as it was made known that diseases arose from ill-lit, ill-ventilated, and insanitary dwellings the diseases gradually decreased in frequency and in some cases have become almost completely exorcised.

When we consider the diseases which have recently increased and which are at present increasing, we observe this similarity ; they are the result of surroundings or conditions which have been thoughtlessly brought about by the agency of civilized man. The diseases which have increased are so obviously associated with the food that the wonder is that the explanation has not been already worked out in detail. That the food we consume, and more especially the food which children are *compelled* to consume, is in some respects radically different from that which was consumed in bygone ages may readily be observed when we recognise that cow's milk and the prepared cereal foods were quite unknown to precibicultural man and all his progenitors. The processes of refinement, and the elaborate methods of preparation of food should at once suggest that the alimentary canal may not be wholly or perfectly adapted for the foods which are now presented to it. Of course it will be claimed that the methods of preparation are brought into existence in

order to suit the requirements of the alimentary canal, and in some ways it may be admitted that the end desired is partially attained. The question however is, has the process of refinement not frequently brought unexpected derangements? An inquiry into the nature of the foods which have been subjected to refinement shows us that the refined products are much more nutritious, and that the innutritious matter which naturally accompanies natural unprepared foods is partially or even totally eliminated, as for example in sugar. As a very general rule the matter which is excluded is cellulose, an inert, indigestible or rather an inassimilable material of a more or less fibrous nature. Thus a result of the refinement of food is the elimination of this part which on account of its physical nature demands a large amount of mastication. Now having admitted that the alimentary canal has through countless generations become adapted for food which contained quite a large amount of this innutritious matter, can we go on satisfactorily without a fairly liberal supply of cellulose? I venture to say we cannot. "It is impossible for the intestine to perform its functions properly unless there is a very considerable amount of inert matter for it to transmit." This has of course been long recognised by physiologists, but it would really appear that it had been quite overlooked by medical practitioners. The current practices among medical men have come about from several causes, among which we may mention the fact that physiologists, when dealing with the inert matter have little to say about it because it is inert. It passes along the alimentary canal to be evacuated, it never really enters

the body and hence the detailed consideration of it is supposed to be superfluous. The very fact that this matter is called inert is a mistake and misfortune. It is only inert from a chemical point of view. Its presence in the intestine is a continual stimulus, and this in itself is of considerable importance in an age of constipation ; but all forms of "inert" matter are not similarly stimulating, and which forms are most suitable for certain kinds of dyspepsia have apparently been considered of no importance nor have they ever been investigated. Thus it is that the medical practitioner in his student days has the importance of this subject but little impressed on him. Then again in active practice the physician is continuously having presented before him emaciated children who obviously appear to require more nourishment, and as is quite natural the doctor prescribes food which he knows from the reports of chemical analysis contains a large supply of assimilable nourishment. Very frequently during the last few years I have read the reports of the analysis of different foods, and I cannot remember ever having seen any mention of the nature of the inassimilable matter, and foods are actually belauded because they do not contain more than one or two per cent. of non-assimilable matter. This would be all right if the patient had been trying to live on turnips and cabbages, but the diseases which have increased, have done so principally among those classes which have had a liberal supply of highly nutritious foods.

Again throughout the whole course of evolution the instinct to select the nutritious, and reject the innutritious was beneficent, for until recently although the food was

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selected with care there was always plenty of the innutritious part. So that independent of current teaching there is no doubt a tendency for people to take too much nutriment, and too little innutritious matter when they get the chance.

Several other factors which have led to the craze for highly nutritious foods will be noticed in succeeding chapters, and the above remarks must only be considered as introductory.

## CHAPTER III.

### THE PHYSIOLOGY OF MASTICATION.\*

In the following description of the act of mastication taken from Huxley's "Elementary Physiology," there seems to be an incompleteness if not an error. It runs: "When solid food is taken into the mouth it is cut and ground by the teeth, the fragments which ooze out upon the outer side of their crowns being pushed beneath them again by the muscular contractions of the cheeks and lips; while those that escape on the inner side are thrust back by the tongue, until the whole is thoroughly rubbed down. . . . When the food is sufficiently ground, it is collected, enveloped in saliva, into a mass or bolus which rests upon the back of the tongue, and is carried backwards to the aperture which leads into the pharynx."

It will be observed that this description would lead one to think that the food is comminuted, mixed with saliva, and made into bolus form and then swallowed.

What actually takes place is very different. Firstly, however, it must be noted that certain food-stuffs which are consumed at the present day are hardly subjected to the process of mastication at all. The food is simply

\* Published originally November, 1900, *British Journal of Dental Science*.

taken into the mouth, receives a general squash between the teeth or between the dorsum of the tongue and the hard palate, and is then swallowed. This method of mastication—if mastication it can be called—is, as a rule, adopted for custards, fine meal porridge, soft puddings, and soft non-fibrous foods generally.

When there is a certain amount of coarse or fibrous matter in the food-stuff, then the process is essentially different, and mastication is performed in a more thorough manner. In this latter case, the food is crushed and torn between and heaped on to the masticating surfaces of the teeth by the muscular contractions of the tongue, cheeks, lips, and motions of the lower jaw. During comminution between the teeth, the juices of the food-stuffs, the saliva which becomes incorporated, and the suspended non-fibrous part, are pressed out from the fibres and gradually collect during the process on the middle of the dorsum of the tongue, which is gradually hollowed out for the reception of such food, and this part is then swallowed. The fibrous part of the food, however, is subjected again and again to the crushing and disintegration between the teeth. If any of the fibrous part passes towards the back of the dorsum of the tongue, it is arrested by the pressure of the anterior part of the tongue against the rugæ of the palate, and while the fluid and finely comminuted part gets sucked or pressed back into the hollow formed at the back of the dorsum of the tongue, the coarse and fibrous parts are thrown between the teeth and subjected again to the crushing, squeezing, and comminution. The rough surface of the tip and dorsum of the tongue and the

smooth-ridged palate are especially well adapted for this separation of the food prepared for swallowing, and that which requires further mastication.

If careful note be taken of this process, therefore, it will be found that the food is not, as a rule, formed into a bolus and then swallowed, but that the bolus is continually slipping away to the dorsum of the tongue to be swallowed till there is almost or quite no bolus left at all.

The recognition of this, which I consider the essential nature of the process of mastication, is of great importance, for, as I have pointed out elsewhere,\* the effect of chewing food of a more or less fibrous nature tends to dislodge the fine particles of food-stuffs which otherwise are apt to lodge between and in the crevices of the teeth, and then give rise to dental caries.

At the present day there is a positive craze for the elimination of coarse and fibrous matter from the food-stuffs, and thus to a certain extent real mastication can be but imperfectly performed, and its beneficent effects are almost wholly lost.

It is well known that the lodging of food-particles (especially carbo-hydrates) in the mouth is liable to bring about caries of the teeth, and if the chemical nature of the fibrous part of the food, even that taken from the vegetable kingdom, be taken into consideration, it will be observed to be less amyloseous or saccharine than is the non-fibrous part.

There are other ways in which the masticating of fibrous food is beneficial. Not only are the teeth kept cleaner

\* "The Cause and Prevention of Decay in Teeth."

than a tooth-brush can keep them, but the salivary and buccal secretions are more thoroughly stimulated, the deposit of tartar and the recession of the gums are prevented, and the tongue when required to perform the requisite motions during the process of thorough mastication develops more fully, and brings about a more regular set of teeth than can possibly be got if the tongue is not well developed. Finally the stomach and intestines are supplied with that more or less innutritious matter which is necessary for the healthy performance of their functions.

It is, I believe, partly on account of a want of a correct knowledge of the Physiology of Mastication and its beneficent effects, together with an almost exclusive consideration of the food-stuffs from the point of view of assimilability, which leads to prescribing foods for invalids and children which are almost invariably so refined and prepared as to encourage little or no mastication.

A thorough appreciation of the process, the essential nature of which I have simply alluded to, its beneficence when well performed, and its seriously harmful results when it is not efficiently performed, would, I feel sure, work a total change in our conceptions of what are supposed to be good wholesome foods at the present day.

The beneficent results of mastication *cannot* be got by trying to go through the process if the food is not fit for mastication. It is therefore useless to tell patients that they must masticate their food without at the same time prescribing food which can be, and in fact requires to be, thoroughly masticated.

## CHAPTER IV.

### SOME EFFECTS OF THE REFINEMENT OF FOOD.\*

THERE are at present several different dietetic theories of the cause of the prevalence of dental caries ; one element, however, is common to them all, namely, that the change brought about by modern processes for preparing and refining food is answerable for the prevalence of the disease. It is maintained by some that the removal of the husk from the grain, for example, impoverishes the amount of bone-forming salts, phosphates, etc. ; by others, again, that the removal of the husk diminishes the amount the jaws require to be used and deleteriously affects the blood-supply and consequent nutrition of the teeth. By still others, the refinement of the foods is supposed to cause the food-stuffs and bacteria to be specially lodgable in the crevices of and between the teeth, etc. It is not my intention to enter into a discussion on the relative merits of the different views ; suffice it here to say that if we maintain that the elimination of the coarse and fibrous elements, *e.g.*, the husks of the grain, the skins of fruit, the tough parts of meat, etc., is harmful to the teeth, we are bound to consider whether the supposed advantages

\* Paper delivered before the Odontological Society of Great Britain, June, 1902.

gained for the stomach and economy in general by such refinement are of more importance than the deleterious effect upon the teeth.

It does seem very surprising to maintain that the refined foods which are prepared with all care should be conducive to such havoc in the teeth, while that very refinement *appears* to be a necessity for the stomach. It is as if we would maintain that Nature had adapted us so that we must always exist between Scylla and Charybdis. I very frequently tell my patients that they must give up feeding their children on refined foods, and am generally met with the rejoinder that the stomach is of much more importance than the teeth, and that coarse and tough foods could not be digested by the patient, much less by children. With children's specialists, too, a like idea prevails. They appear to think that in general the feeding of children, as advocated in current text-books, is as sufficiently nearly correct as is necessary for all general purposes. This, however, I believe to be an erroneous idea.

Let us approach the subject philosophically. Firstly, let us consider the subject deductively from biological principles, and having found the general principle let us subject it to the test of facts so far as they are known and admitted.

It is a general law brought about by the agency of natural selection that animals, when subjected to any particular environment, either become in the course of generations adapted to that environment or else die out as a race, and that in the event of them having become adapted to the environment, they thereby acquire a

hereditary structure which tends to continue indefinitely till impressed forces or change of environment changes that hereditary structure. It follows that animals are adapted to that environment under which they have lived for countless generations, and are not adapted to a changed environment when such is forced upon them.

To descend now from the general principle to the case in hand. The ancestors of present-day man, savages, Anthropoid progenitors, etc., lived a life which necessitated their living largely on natural foods. The environment remained practically the same from one generation to another, and the hereditary structure became eminently adapted to this environment. As regards these foods, they were simply much the same as the natural foods are to-day before they are subjected to processes of elaborate refinement and cookery. The hereditary structure according to biological principles still survives, if not in its entirety yet in great part. That we are structurally unfitted to the new foods is amply manifested by the fact that about 95 per cent. of us are now well supplied with carious teeth and a similar percentage troubled with chronic or occasional indigestion. I will say, at least, that carious teeth and dyspepsia are among the very commonest afflictions to which man is subject. We know that prehistoric man had relatively excellent teeth, and we know also that Nature would have made short work of him had he been crippled with dyspepsia. We know, moreover, that in their natural environment savages and anthropoids are not very subject to dyspepsia. In fact, they must maintain themselves in fairly vigorous health

throughout their whole life, or succumb to their natural enemies.

Since it has been ascertained that acquired characters are not transmitted, we must conclude that civilized man should have just about as excellent a digestive apparatus as uncivilized man or his progenitors, and that decayed teeth and indigestion are practically in all cases brought about by avoidable indiscretions, especially indiscretions in diet. This, at least, is my belief, and a perusal of what follows may show the likelihood of the general truth of the assertion.

Let us consider the matter from an analysis of known facts. Food must, according to the physiologist, supply the following requirements; it must contain a certain amount of proteids, carbo-hydrates, hydrocarbons, salts and water, and, what is most important from the point of view of the present paper, it absolutely must contain a certain and considerable amount of *indigestible, innutritious, and unabsorbable* matter. This fact is very generally overlooked, and it is the origin of most of our digestive and dental troubles. Do not many of children's troubles arise from constipation and the varied decomposing products generated in the intestine from the lodgment of food? Is not the very first step in the treatment the administering of some drug which will clear out the foul mass of faecal matter? A very general state of affairs is first a gradual onset of constipation, then a purge, and the patient goes on well again with a tendency to constipation, which must inevitably increase if a reasonable amount of unabsorbable matter is not given. Special care

is taken not to give anything irritating, for it is supposed that if such food is given it will, of course, augment the evil effects of the fermenting mass in the intestines. But surely, this is a stupid way to go on. Would it not be much better to allow a moderate amount of inert, in-nutritious matter, such as cellulose, to remain in the foods? A sufficiency to stimulate the peristaltic actions of the stomach and intestines, and so induce a continuous, regular, and rhythmic performance of this natural function. It is extremely difficult for the intestine to transmit tiny quantities—a “very considerable quantity” is necessary.

“This extraordinary care” which is taken “to employ nothing in our diet but matter which has nutritive value, that is, can be absorbed into the system is founded upon want of knowledge of the first principles of digestion, and yet, strange to say, the mistaken, indeed mischievous, practice is supported, probably for want of thought, by many who ought to know better.”\*

A fact of some significance is that very many cases of chronic dyspepsia are due to want of sufficient movement of the stomach or intestines, or both. Here, again, the stimulus of a coarse and fibrous diet would in the early stages presumably avert the disease. I may here refer to the fact that frequently a loose use of certain words gives rise to much error. Thus the word “indigestible” is frequently used as meaning taking a long time to digest or as giving rise to dyspeptic symptoms accompanied by pain. A patient may pass inert matter almost in the state in which it was swallowed, and it may

\* “Food and Feeding,” by Sir Henry Thompson.

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then be said to be obviously indigestible, meaning "*unabsorbable*." The patient is promptly told to avoid eating this substance again, because it is indigestible in the sense that it requires a long time to digest. Such foods are, however, *ex hypothesi* inert, they pass through the body unchanged and exert no action, or at least only that muscular activity of the intestine which is necessary to transmit them, and which is so necessary to be kept in a high state of efficiency.

So far, therefore, as regards the necessary innutritious matters in the food-stuffs are concerned, the refinement does not appear to be any more beneficial from the point of view of gastric digestion than it is premised to be from the point of view of the teeth.

Now let us turn our attention more especially to the carbohydrates. Let it be remembered that the starchy matters of the food are to a considerable extent digested by the action of the ptyaline of the saliva in the mouth. Let it be remembered, too, that when the starch passes into the stomach its digestion is after a very short time completely arrested. Now, if the starchy matter is much refined and taken in a form in which it does not require to be retained in the mouth and masticated, then, of course, it is passed rapidly into the stomach and the salivary digestion is almost *nil*. The stomach is liable to be overloaded with undigested starch and the various disorders of amylaceous dyspepsia may result. If, however, the innutritious fibre, which is to a large extent cellulose, had not been removed or pulverised in the process of refinement, then the teeth would have had to

perform their natural function ; the food by its coarseness would have necessitated thorough trituration and insalivation ; the starch would have been much more thoroughly converted ; the stomach would not have been overloaded with an unnecessary amount of unconverted starch, and the innutritious cellulose would stimulate the rhythmical action of the stomach and intestine, which is frequently so sluggish.

It is somewhat curious to notice the devices which are being adopted to overcome the harmful effects of refining the carbohydrates. One error is introduced to rectify a previous error ; whereas a study of natural foods and Nature's methods indicates that the first error should be corrected and the supplementary secondary errors would be superfluous. Malted foods and predigested starch are administered in the hope of rectifying matters, but whether this is really properly accomplished is, according to Aitchison Robertson,\* doubly doubtful.

With regard to sugar, the effect of refinement is particularly harmful. The refinement of the food-stuffs from which sugar is obtained is carried to such an extent that instead of the succulent tuber of the beet or the fibrous sugar-cane we get the highly concentrated and crystalline product we know as sugar. Now it is known that sugar can be easily swallowed in quantity, and the result on the gastric digestion is to cause irritation and an excessive secretion of mucus in the stomach. I think, too, that this excessive secretion of mucus takes place in the mouth from like irritation. The harmful effect on both teeth

\* *Journal of Anatomy and Physiology*, 1898.

and stomach is generally acknowledged. If, however, the sugar could only be got in the relatively unconcentrated form by chewing the beet or the sugar-cane, the secretion of mucus might only be beneficial in coating the innutritious cellulose and putting it in a fit state for passage along the alimentary canal. Within limits, too, the mucus probably acts as a protective coating to the teeth. Moreover, retention of sugar in the mouth in a dilute form, together with the fresh vegetable juices which accompany it in the sugar-cane, stimulates the flow of saliva and facilitates its conversion into a less irritating and more assimilable form. The fact that the eating of sugar stimulates thirst suggests the natural need for its dilution, and the fact of the secretion of mucus suggests the adaptation of the organism to cope best with this article of diet when taken in the form in which Nature presents it to us.

With regard to hydrocarbons, fortunately, when deprived of the fibrous envelope in which the fat globules are usually enclosed, that is, when refined to the extent that sugar is refined, they are too disgusting and sickening, and are consequently less apt to be harmful. Still, ways and means have been found, and muffins soaked in melted butter, or pastry of a similar constitution, are easily swallowed. Fats as foods in Nature are presented with an enveloping membrane. They do not hinder digestion as they are thus at least partly emulsified. It is otherwise when the fat or oil is made to surround the starch and other food-stuffs, for then the fat acts as an envelope excluding the digestive juices, and so hinders

digestion. Possibly, if the oils or fats which are incorporated in nuts, or fruits, or flesh were taken in a more or less natural form, more benefit would accrue to the teeth and less harm to the stomach.

With regard to proteids, they are usually eaten in a more or less natural state and the beneficial effect to the teeth is recognised, while, should the cooking not be bad, and the amount reasonably limited, the stomach is well able to derive benefit from them. The really refined proteid diet is, however, the beef essence, meat juice, extract of ox in a tea-cup class of foods. They are more harmful to the digestion, for though, indeed, they are easily digested, inasmuch as they are quickly passed out of the stomach, and completely absorbed, they set up a secretion of acid and an unnatural craving for food at short intervals, which is equally harmful both to teeth and stomach.

With regard to the salts, especially the earthy phosphates which are eliminated with the refinements of foods, as, for example, those contained in the husks of grain, the want of a sufficient supply of these in the diet may possibly cause some derangement in the natural functions of the digestive organs. Possibly the beneficial results got by drinking mineral waters—natural and artificial—may indicate an incidental benefit by their general retention in the food-stuffs. The fact that a mixed diet is more beneficial than one containing almost solely proteids, carbohydrates, or hydrocarbons is recognised in our ordinary daily dietary, but I should also insist on foods being mixed still further, inasmuch as the food ought to

be partly fibrous as well as non-fibrous, as the fibrous part necessitates mastication and consequently insalivation. The mastication necessitated by the fibrous part sets free the starch so that it may be converted by the saliva, disintegrates the proteid matter, and allows of the covering of the mechanically irritant part with a coating of mucus, while the mastication stimulates the flow of lymph and prevents the harmful results—to which Dr. Harry Campbell has called attention—of the stagnation of the lymph in the neighbourhood of the muscles of mastication.

It should also be remembered that water taken *after* meals not only tends to cleanse the mouth, but when it passes into the stomach it stimulates peristalsis and helps digestion.

There are also some general effects on the stomach produced by the refinement of foods to which attention should be drawn, for example, the ease with which refined foods can be swallowed and the want of bulk composed of inert matter leads to a very general habit of over eating. The requirements of the body can be satisfied by a small amount of highly concentrated food, but if the inert and tasteless matter is absent the palate is keenly whetted, and until the stomach is moderately full more is easily eaten. If, however, a moderate amount of innutritious fibre has to be consumed, not only is the stomach gradually filled, but the amount of saliva swallowed is considerable and the digestive juices add their little to fill the stomach, and bring about a feeling of satisfaction.

No doubt coarse food, or food which contains a fair

proportion of cellulose, takes longer to digest—is delayed longer in the stomach—but this is no disadvantage whatever, all that is required is to leave longer intervals between meals. Five or six hours between each meal is much better than the habit, engendered by eating too quickly digestible meals, of nibbling between meals, or the taking of four, five, or even six meals a day.

There is a class of foods which are sometimes confused with those inert substances and classed roughly as indigestible. I refer to irritant or even poisonous substances, they are soluble, and may give rise to more or less violent irritation of the stomach. Many foods contain such irritants and, of course, should be avoided, especially concentrated or in excess. So, too, those foods which give rise to irritant products during the process of digestion should not be eaten. As a precaution against the formation and lodging of such substances care should be taken that sufficient inert matter is consumed to stimulate regular evacuation of the bowels.

There is another general consideration seldom thought of, that is, the strengthening of the digestive apparatus. People who have not much to do are often what may be called healthy, but those who lead an active life are stronger and healthier. So, too, people may be able to eat ordinary refined meals and do fairly well upon them, but throw a little extra strain on their digestive organs, and they break down. This, I believe, is the "normal" state with many people. Men, however, should have a much more powerful digestive apparatus than this if only it is kept regularly in vigorous activity. This may

gradually be brought about by eating a less refined diet at longer intervals. The muscular powers of the stomach and intestine are as easily developed or allowed to grow flabby as are the muscles of the rest of the body. There are limits, of course, to the eating of coarse and fibrous food. There are natural guides for this also. For example, take the tail end of a chop and masticate it more or less, then take a corresponding amount of potato, masticate still further, and it will be observed that the potato is swallowed while the too fibrous part of the chop remains ; take more potato and masticate and still it will be found that the more fibrous part of the chop remains. Such fibrous parts may be avoided.

Here it should be remarked that I thoroughly appreciate the beneficial effect of the refinement of food and its preparation in a very easily digested or even predigested form in cases of debility, whether general or localised in the digestive organs. Minced meat, pounded fish, fine bread, partially converted starch, etc., are equally beneficial, both when the teeth are absent or inoperative and when the stomach is weakened by disease. So, too, milk in small quantities at frequent intervals is undoubtedly of great use in many cases of acute dyspepsia. Little good can be derived by stimulating an already over irritable stomach. Rest in bed is frequently the best possible treatment for certain debilitated conditions of the system, but vigorous exercise is much more conducive to good health with those who are not debilitated by disease. This leads me to state one reason why the craze for the refinement of foods has come about. I am firmly con-

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vinced that many specialists are largely to blame. Doctors are continually associated with the weak and diseased. Recognising the need of nutrition at the least possible expense to the economy, they naturally advise foods which will be easily and readily assimilated. They observe over and over again that when such invalids throw excessive work on their digestive organs they break down, just as many people find that when eating coarse food their teeth break, and a carious cavity shows itself. They naturally recognise the immediate cause, while forgetting that the original cause has been working, either in weakening the teeth from caries, or the stomach from want of vigorous exercise, perhaps for years. The coarse food brings about the crisis, but the refined food has insidiously performed its mischievous effects, which are bound sooner or later to result in a breakdown.

Rest is undoubtedly advisable when an organ has broken down, but by exercise alone can we expect to regain vigorous health. We must not continuously advocate the diet of the sick for children and healthy adults, even if they are not particularly strong. The subject, too, is not clearly presented in medical books. Although medically qualified myself, I had, since graduating, considerable difficulty in arriving at anything like a clear understanding of the subject. We have tables of digestibility presented to us which say, for example, that boiled rice takes one and a half hours to digest, others that it takes three to three and a half hours. We read, however, that rice is largely composed of starch, and that the digestion of starch in the stomach does not take place at all,

facts and argument Dr Wallace accepts the correction.

It is highly desirable to feed on food requiring considerable mastication for the sake of complete mastication and consequent mastication, but it only puts an unnecessary and perhaps harmful burden on the stomach to swallow any indigestible matter. Habitual

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at least only to a very slight extent, and then only during the first twenty minutes or half-hour that it lodges in the stomach. This is, of course, rather confusing when one wants to arrive at a definite understanding of the subject. It might possibly be useful if, when the word "digestible" is used, it were made quite clear whether chemical digestion, or physical digestion, or absorbability was meant: so, too, when the word "indigestible" is used, it would be well to know whether the food-stuff was meant to take a considerable time to undergo chemical or physical digestion, or whether it was unabsorbable, or whether it was of such a nature that it gave rise to gastric or intestinal trouble, either from its irritant nature or from an irritant nature acquired during the process of digestion.

Then, again, if carefully read, it will be noticed that "bulk," "ballast," or "innutritious matter" is a necessary constituent of a healthy diet. But this subject is dealt with so cursorily that one is left almost wholly in ignorance as to what these substances are and as to the quantity required. A definite recognition of the amount of proteid, carbo-hydrate, fat, and water, is clearly set forth as necessary for a man of such and such a weight performing no work, or moderate work, or hard work, but no recognition is taken of the quantity of innutritious matter. Again, although this innutritious matter is spoken of as inert, strictly speaking it is not so. It stimulates peristalsis, and some forms of it may stimulate peristalsis more vigorously than others, but an investigation into the nature of the different kinds of innutritious matters requires to be made. Although a return to eating

cultivated in civilized man; acts merely as storage -  
for abnormal quantities of food; and constipation from this  
is more liable than when the muscular tissues surrounding

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the natural food-stuffs would, I have no doubt, be sufficient to bring about a healthy and vigorous digestion, yet accurate knowledge is wanted.

It is especially with regard to children's feeding that a correct knowledge of what is best is most necessary: and here I should like to make a few observations in regard to a theory which seems to me to be worthy of consideration. It is known that a knowledge of the dentition of extinct animals gives a clue to the methods of feeding of these animals, and I believe a recognition of the dentition of children forms a guide to the correct feeding of a child. I do not refer only to the fact that up to the time of cutting the incisor teeth the diet ought to be solely the milk which Nature supplies, nor to the fact that the existence of temporary molars indicates that food ought to be given which requires to be masticated. These facts are already recognised, at least theoretically, by many, but the perplexing period is the time between the cutting of the lower incisors and the appearance of the temporary molars. It is during this period that much difficulty is found in regulating the diet of infants, for the appearance of the incisors indicates that suckling ought to be stopped, and in fact it occasionally forcibly does stop this natural process. The child must be weaned. A sudden change to the foods which are procurable in a natural state would, as administered at the present day, give rise to gastric troubles. Natural foods are always accompanied by a considerable proportion of inert matter which would be apt, if not certain, to induce indigestion. Consider the instincts of the child. Its indomitable habit of gnawing all edible

be interested in the book and must say <sup>3-2</sup> I feel extreme honor in having it introduced to your mother by Mr. Fletcher.

J. Sam Wallace

substances presented to it together with its inveterate habit of sucking. Add to this that it first cuts two lower incisors, then the two upper central incisors, and shortly after the two upper lateral incisors. This being completed, there is a long interval of about five or six months before the cutting of the next group of teeth, which includes the lower lateral incisors and the four first temporary molars. Now during all this long time the child possesses two lower incisors. And they are sharp. Surely all this indicates that the best way to wean a child is to give it succulent foods which it can pierce with its incisors, especially the lower ones, and suck the juices from such foods. Why should starch be so difficult for the infant to digest? Surely it indicates that during the process of evolution the child sucked soluble matter? To supply the carbohydrate food, the sugars, the soluble starches and the vegetable juices would be consumed, and doubtless the craving for sugar and vegetable acid indicates a beneficial provision of Nature to put the child in fit correspondence with its natural environment. This undoubtedly would supplement the delicate morsels from the animal and vegetable kingdoms which the primitive mother could procure for her child. No doubt, too, the fresh vegetable juices exert beneficial effects, at least it is generally recognised that a good supply of these juices is necessary to prevent the occurrence of scurvy, rickets, and other diseases which are sometimes inflicted on infants through the agency of modern civilization. This indicates that *children* should not get much inert and innutritious matter from about the seventh to the fourteenth month. I have knowledge

of a little infant who, during this period, was given orange liths, which he relished : he chewed them so far as he could, but was always willing for the fibre to be taken from his mouth after he had extracted the juices. He opened his mouth for the purpose, and did not show much disposition to swallow the innutritious fibre, at least in quantity. And with regard to sugar-cane, which he relished even more, he chewed it with his incisors, sucked out the juices, but did not try to swallow the fibrous part.

With the advent of the temporary molars more solid food should be given, and at this period starch can be much more easily borne. By this time the salivary glands have largely developed, and the stimulus given by continual gnawing and sucking, and sugars and vegetable juices, largely promotes the growth and functional development of these glands. Next consider the shape of the molars. Is there not a large grinding surface on each? If man were a carnivore this would be hardly necessary, but being partly a vegetable feeder it is necessary for the vegetable food to be masticated, for the cellulose enveloping the starch to be crushed, and for the starch to be at least partly digested in *the mouth*. By the time all the permanent molars are in position the child is able, within limits, to eat anything, and only a vicious civilization is able to undermine the natural and powerful digestion which by this time ought to have been gained.

As guides in the feeding of children, the following points might be attended to :

(1) A knowledge of the natural food-stuffs which have in past ages been habitually given to children.

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(2) Knowledge of the artificial foods which are generally used, together with a knowledge of their defects, physical and chemical.

(3) A recognition of the likes and dislikes of the child with regard to natural foods.

(4) To introduce only one new food-stuff into the dietary of a child at once, and to make sure that this agrees with the child before making further alteration.

(5) To increase the intervals between meals according to the length of time required for digestion in the stomach ; this attention is to be regulated by previous knowledge, the appetite of the child, and the needs of civilization, *i.e.*, regularity of meals and ultimately three meals daily.

I need not pursue the subject further. Enough has been said to show that the teeth and the stomach require similar food, and it is only our habit of disregarding the dictates of Nature and common-sense which leads to any such supposition as that the foods which are suitable for the teeth are harmful to the stomach.

NOTE.—A large supply of true cellulose is strongly advocated both from the point of view of the teeth and the alimentary canal, but derivatives of cellulose such as lignin and suberin should only be sparingly consumed. Thus the skin of fruit should, as a rule, be removed and wholemeal bread indulged in sparingly. It must not be supposed, however, that the rôle of cellulose cannot largely, if not entirely, be filled by any other article of diet. Thus with the Esquimaux oil or fat takes the place of cellulose, and even in European countries children are frequently restored to health, at least for a time, by the aid of continual doses of castor and cod-liver oil.

## CHAPTER V.

### NASAL OBSTRUCTION AND MOUTH-BREATHING.\*

WE who are concerned with the health of the community must look with satisfaction on the progress which has been made in hygiene and sanitation, for these sciences guard the avenues leading to physical well-being. So, too, we must look with satisfaction on the progress of medicine, and the decrease and eradication of many diseases. So, again, we cannot but be gratified by the general advance of science, which in its application has led to an enormous increase in the production of the necessities of life, and has even allowed what once were considered luxuries to come within the easy reach of all thrifty members of the community. Lastly, we must feel much satisfaction in the diffusion of knowledge relating to the laws of health to an extent which could hardly have been dreamt of by the medical practitioner of half a century ago. On the other hand, it must cause us disappointment and chagrin when we think of the alarming increase of certain diseases which we are as yet unable to control or prevent. It is one of these troubles which is rapidly becoming more prevalent that we have met to-day to discuss. Nasal

\* Paper delivered before the British Laryngological, Rhinological, and Otological Society, January, 1905.

obstruction is now quite a common disease, although but a few generations ago it was practically unknown. This can be easily proved, because nasal obstruction and mouth-breathing give rise to a characteristic deformity of the jaws, and to an easily recognisable irregularity of the teeth. The mouth-breather's jaw is absent in all but recent collections of skulls. Even in the Hythe collection, which is probably only a few hundred years old, there is, I understand, not a single example to betray the existence of mouth-breathing at that time.

When we recognise these facts, we naturally ask, What change has taken place which will account for the increased prevalence of nasal obstruction and mouth-breathing? One would naturally suppose that in all probability the artificial warming and imperfect ventilation of houses might be the chief change and initial cause. The sudden changes in temperature to which the nasal mucous membrane is subjected on passing from a heated room to the cold outer air, can hardly be otherwise than prejudicial, nor can a stuffy and germ-laden atmosphere be considered conducive to the health of the nasal passages.

Dr. Scanes Spicer holds this view, and says: "In this way the nasal mucous membrane gets into a state of inferior vitality and irritable weakness, and erects, inflames and hypertrophies. . . . The secretions of the disordered mucous membrane become abnormal and irritate the lymphoid channels and follicles in the naso-pharynx, and adenoid vegetations are the result." That these conditions tend to give rise to morbid conditions of the nose and naso-pharynx is, I believe, generally

acknowledged, but that they do not supply a complete explanation of the prevalence of nasal obstruction and mouth-breathing is equally generally recognised.

Another condition, possibly of greater importance, is an interference with the perspiratory function of the nose. The nose is not only a respiratory organ, for it has a perspiratory function also. If we consider what happens when we breathe, we observe that a large amount of air which is drawn into the air passages never reaches the air cells of the lungs at all, but is broken up, forming eddies over the various moist projections and recesses of the nasal cavities. The air which ultimately does reach the lungs gets moistened, of course, but so does that greater amount which is exhaled without ever reaching the lungs at all. When we are at rest in bed and well covered, perhaps too well covered, it is obvious that the general surface of the body is not so well adapted for the perspiratory function as when we are up and moving about, with the air circulating more or less freely around us. In fact, when we are lying at rest the only parts of the body over which a current of air is freely passing, are the walls of the nasal cavities and the respiratory passages. It is thus perfectly natural that if we get warm in bed the nasal mucous membrane will get congested, just as the surface of the body gets congested when we become overheated. If the nasal passages are not unduly narrow, only good would result, for the evaporation caused by the current of air through the nose would help to keep the body temperature normal and prevent undue perspiration elsewhere. I need not refer to the harmful effects of an

undue rise of bodily temperature, or to an undue amount of perspiration at night. What it is of special importance to note is, that the nose is a *perspiratory* organ, and if the function of perspiration is interfered with, various deleterious results are certain to be brought about. Many known facts seem to corroborate this hypothesis; for example, the fact that nasal obstruction is commonest in damp localities—*i.e.*, localities in which the perspiratory function is carried on under more disadvantageous conditions than when the atmosphere is dry. So, too, the fact that children who are “coddled”—*i.e.*, who are kept too warm, often in a close atmosphere, and in general placed in conditions which tax unduly the perspiratory function, are highly susceptible to colds and nasal obstruction. Then, again, we recognise that in the treatment of these troubles a moderate covering of flannel, which will keep the child warm without inducing undue perspiration is beneficial.

Another concomitant of civilization which plays an important part in inducing nasal obstruction is the unsuitable nature of the food upon which children now subsist. Any great change in the habits or in the environment to which man has, through countless generations, become adapted, is almost certain to bring about some harmful results, and that an extraordinary change has come over the food and feeding of children is undeniable. Thus, for example, before cows were kept it is obvious that milk was unknown to children after they were weaned, say between the age of one year and two years, nor were the proprietary foods which imitate

milk, available for children. Nor was bread, nor porridge, nor milk pudding available, so that the staple articles of the modern child's diet were utterly unknown to the children of primitive man and all his progenitors.

Those who know of nothing but the orthodox milk diet for young children find it almost impossible to imagine how the children of primitive man could possibly have been reared on the natural foods at the disposal of the untutored or un-Chavassed mother.

In order to indicate the magnitude of the change in feeding to which children are subjected, I shall first briefly indicate the kind of diet which the children of our ancestors were able to thrive upon. After the mother's milk began to fail in quantity and quality, and the child had erupted two sharp little incisor teeth, the child had, I believe, to supplement the decreasing milk supply by using its teeth to pierce the succulent and more or less nutritious roots, shoots and fruits which had been procured for it to *gnaw and suck*. This, together with some little animal food, probably gnawed and sucked from a bone, had to serve in increasing quantity for the decreasing supply of milk until about the thirteenth month, when the first molar teeth appeared and allowed some food also to be actually ground or masticated. After this age was past, the sucking process became gradually abandoned, while mastication became more thorough, until the primitive child became able to eat all and sundry with his parents. Here, be it observed, the carbohydrates, consumed after laborious gnawing and sucking, were unlikely to give rise to indigestion. They

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were diluted and much too thoroughly insalivated to escape without conversion or preparation for the stomach. Nor were the salivary glands denied their natural stimulus for full and healthy development. If we consider the natural period of lactation, the time of eruption of the gnawing incisor teeth and of the masticating teeth, together with the time of appearance of ptyalin and the natural stimulus for its secretion, we see that the prehistoric child was well adapted for its primitive surroundings, instinctively, anatomically and physiologically. Compare this with the recognised ordinary methods of feeding at the present day, and we find that the foods are in but few ways suited for the anatomical, physiological, or instinctive peculiarities of the child. Instead of being gradually weaned and given food which will demand gnawing, sucking and insalivation, it is cheated into gulping down concentrated carbohydrate food such as bread soaked in milk, porridge and milk, milk puddings, and potatoes and gravy. It seldom gets the chance of learning to separate the liquid part which is fit for swallowing, and leaving or rejecting the innutritious fibre which so often accompanies natural foods. Nor does it get the chance of learning to masticate its food in such a way that the fluid and finely comminuted part is swallowed first, while the less finely ground part which requires further mastication is thrown back on to the teeth again and again until it, too, is finely ground and thoroughly insalivated. In a similar way, the physical homogeneity of the soft milk-soaked diet prevents the stomach from acquiring the habit of allowing the digested part of the

food to pass on through the pylorus, while it forces back the insufficiently digested part into the body of the stomach to be more thoroughly digested. But to cut a long story short, the modern child frequently, perhaps usually, falls into a state of chronic indigestion, and three of the consequences which usually follow must be mentioned, as they tend to bring on nasal obstruction. The first consequence of chronic indigestion to which I would refer is a correlated disturbance in the neighbourhood of the naso-pharynx. We know of the flabby state of the tongue and the red and swollen papillæ and sides towards its root. We are aware that even in adults, who are not so subject to inflammatory swellings as children, "enlargement of the tonsils is not infrequently present in cases of gastric insufficiency," and this is especially so "when occurring in children near puberty" (Sidney Martin, "Diseases of the Stomach"). Finally, that the pharynx is red and congested in many cases of gastric disturbance, is recognised by those who have specially directed their attention to this subject. Is it then a great difficulty to suppose that the pharyngeal tonsil undergoes a similar enlargement to the faucial tonsil? Is it not the case that hypertrophy of the faucial tonsils is presumptive evidence of the enlargement of the pharyngeal tonsil? I need not mention the effect which this enlargement of the pharyngeal tonsil has in predisposing to mouth-breathing, and possibly also to colds, scarlet fever and measles, which in themselves are by no means without suspicion in causing adenoid vegetations.

Chronic dyspepsia with concomitant malnutrition may predispose to nasal obstruction in another way. It would appear to derange the perspiratory function and bring on attacks of perspiration from trivial causes. It is perhaps partly on account of this that the idea of an association between rheumatism and adenoids has arisen, for the disturbance of perspiration, together with cold and damp, is, as we have seen, likely to predispose to adenoids as it does to rheumatism.

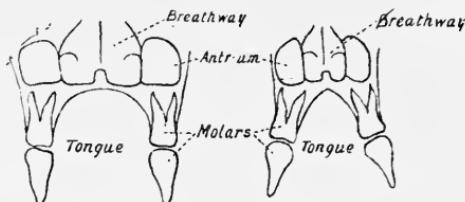


FIG. I.

FIG. II

Diagrammatic representation of a section of the mouth and nose to illustrate the palate and position of the teeth when: (1) The tongue has been normal; and (2) when the tongue has been small or emaciated during the development of the palate.

Lastly, indigestion may predispose to nasal obstruction and mouth-breathing by the emaciation and general lack of strength to which it gives rise. How this comes about must here engage our attention. We know that the growth and development of the maxillæ are intimately associated with the growth and development of the tongue. The general truth of this contention has now been so fully corroborated by the elaborate investigation and careful measurements of Dr. Grevers, of Amsterdam, that I do not feel called upon to recapitulate the evidence

which originally led me to recognise this truth. All I need here say is, that a normal or unemaciated tongue stimulates the growth in breadth of the maxillæ and brings about a broad palate.

But just as the palate is made broad by this stimulus, so, too, is the base of the nose similarly broadened, and consequently, the part which is, *par excellence*, the respiratory part is correspondingly broadened. It is known to dentists, at least, that any mechanical force, when acting in the mouth more or less continuously, will expand the dental arches, and if the tongue grows as it ought, it must necessarily press the dental arches outwards also. The suture between the maxillæ allows of the deposition of bone and consequent separation of the bodies of the maxillary bones, provided that there is something to stimulate such growth. What could be more natural than that the developing tongue should be the normal stimulus? On the other hand, it is only natural that if the tongue is emaciated, so, too, will the palate lack breadth.

The growth in breadth of the palate is also stimulated by efficient mastication, for with efficient mastication there comes a corresponding wearing of the cusps, especially of the temporary teeth, and a consequent loss in depth of the mouth, which is compensated for by a corresponding increase in breadth. If the tongue is compressed from above downwards, the lateral expansion is correspondingly increased. Again, efficient mastication stimulates the growth in breadth of the palate, by the fact that it supplies an intermittent strain on the

stitches, especially through the more or less transverse action of the external pterygoid muscles. We thus see that emaciation of the tongue, inefficient mastication, and the lack of wear of the teeth brought about by the soft food given to children, all tend to produce a narrow palate, narrow jaws, and corresponding lack of breadth of the nasal passages. From similar causes the naso-pharynx not only lacks breadth, but also depth from before back, for an inefficiently developed tongue does not cause that normal forward translation of the maxillæ which a fully developed tongue does ; and the lack of the intermittent pressure and strain normally produced, especially by the action of the external pterygoids during efficient mastication, gives rise to a corresponding lessening of the natural stimulation to the deposition of bone between the various sutures which run transversely between the basi-occipital and the maxillæ. Now, in narrow nasal passages and a constricted naso-pharynx we have a strong predisposition to nasal obstruction, and when mouth-breathing is once commenced the chances of spontaneous recovery are almost *nil*, for nasal obstruction itself arrests the further development of the nasal cavities, as has been experimentally proved by von Ziem. Furthermore, nasal obstruction induces mouth-breathing, and this removes the normal pressure of the tongue from the maxillary alveolus on either side, so that still further is the natural stimulus for the natural broadening of the palate, and consequently the nasal breathway, removed.

I might here allude to Dr. Harry Campbell's ideas with regard to the beneficent action of efficient mastication in

stimulating the flow of lymph and blood, and thus establishing a healthier state of the neighbouring tissues ; but I presume you are all well acquainted with his views on these and correlated subjects,\* and will only say that if his contentions are correct they would help to enforce one of my main arguments—viz., that soft foods are responsible for a large amount of indigestion, and indirectly for adenoids among children.

Another cause of imperfect broadening of the nasal passages, is the upright posture associated with prolonged ill-health and malnutrition. When the health is continuously below par the vigorous tonicity of the muscles is lessened, and instead of the thorax being held up in the manner which is characteristic of robust health, it falls somewhat, and an attitude such as that caused by exhaustion becomes almost chronic. But the fall of the thorax and viscera naturally drags hyoid, tongue and jaw downwards from the palate, thus removing the natural stimulus for broadening it, while at the same time the mouth is actually pulled open.

It frequently happens that the nose is specially congested at night, while but little blocking is observable by day. The congestion by night causes mouth-breathing by obstruction, while the conditions just referred to predispose to mouth-breathing by day. If the child were in vigorous health, the mouth-breathing by day would not take place, and the pathological condition in the naso-

\* "Influence of Mastication on the Jaws." *Transactions of the Odontological Society*, 1902, pp. 102 and 120 ; also "Observation on Mastication" (*Lancet*, July 11, 18, 25, and August 8, 1903).

pharynx would have a much better chance of recovery. Thus, then, delicate health from indigestion or any other cause not necessitating the horizontal position, tends mechanically, and otherwise, to induce mouth-breathing and concomitant abnormal conditions.

Another condition to which we must just allude is an imperfect development of the lower jaw, where the ramus joins the body. When mastication is vigorously performed the mandible develops fully in the neighbourhood of the angle, and thus a square and broad jaw is brought about; whereas, when mastication is insufficiently carried on, the angle remains more obtuse. This obtuseness of the angle of the mandible, however, has an effect on the arrangement of the teeth, for it tends to make the molars meet or occlude before the rest of the teeth. In other words, the mouth is prevented from closing. It is necessarily held open. Other effects follow. The upper molar teeth are forced forward, and may either become very irregular, or the incisors may be forced to protrude, and the typical mouth-breather's jaw be foreshadowed. The teeth towards the front of the mouth rise as it were in their sockets till they meet, but it frequently happens that the alveolus is so much deepened that the lips do not close without a special effort, and at least an approximation to the adenoid type of face is closely simulated. From a consideration of these facts it will be seen that the imperfect broadening of the palate associated with mouth-breathing is, or may be, brought about independently of nasal obstruction, and may ante-date it. The stenosis may give rise to obstruction with but little hyper-

trophy of the lymphoid or other tissue which is so liable to hypertrophy.\*

In conclusion, it should be noted that if the general truth of my contentions be admitted, then two important corollaries naturally follow. The first is, that "the cure of mouth-breathing should be carried out by the rhinologist *pari passu* with the treatment of the teeth and palate at the hands of the dental surgeon."† I give this corollary in the words of a distinguished rhinologist, for his words cannot be supposed to be biased in the way in which mine might be. In the treatment of the irregularities of the teeth, we dental surgeons recognise the important help to be derived from the laryngologist in the restoration of the functions of the nose, but I doubt if all rhinologists recognise that some benefit might accrue from the expansion of the palate by the dental surgeon, and by the restoration of the means of efficient mastication.

The second and more important corollary is that we should enter a most vigorous protest against the iniquitous and ubiquitous system of feeding children almost entirely on soft milk-soaked foods. Not because milk is occasionally the bearer of tubercle, scarlet fever, diphtheria, etc., nor because it leads to constipation, fermentation and summer diarrhoea, but because this pap system is the insidious cause of lifelong suffering from the numerous derangements of the alimentary canal which it brings on.

\* A fuller account of many of the structural alterations caused by mouth-breathing will be found in the author's work on "The Irregularities of the Teeth."

† Scanes Spicer, M.D.

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It begins by producing the wholesale ruin of the teeth, together with many consequent troubles. It leads to adenoids and all the unfortunate sequelæ with which you are familiar. Finally, it almost necessarily begets gastric insufficiency, malassimilation, and malnutrition, together with the general wreck of physical well-being which these derangements ultimately produce.

## CHAPTER VI.

### PHYSICAL DETERIORATION IN RELATION TO THE TEETH.\*

THE question of the deterioration of the physique is one of national importance, and we, as members of the medical profession, have a special charge laid upon us to do what we can to maintain the physical well-being at as high a standard as circumstances will allow. I do not intend to go into this general question in all its bearings, but will rather begin by mentioning a limitation. Deterioration may be inherent, and then might properly be called degeneration, or it may be the result of an environment becoming progressively more unfavourable. It is only in this latter aspect that I intend to consider this subject.

It is unnecessary for us to inquire whether there is any increased deterioration in the national physique. For this inquiry it is sufficient that the subject has been raised, and that, as regards the teeth, there are hardly two opinions. Nor can there be, for the teeth of the present day are not at all equal to those of our ancestors, and the further we go back the more obvious is this truth.

\* Paper delivered before the British Dental Association at Aberdeen, August, 1904, and in part at the meeting of the British Medical Association, Oxford, July, 1904.

We may direct attention to the relation between physical degeneration and the teeth from three points of view. First, let us ask whether the degenerate state of the teeth is a result of general physical degeneration. Have we any substantial evidence that the ill-developed classes have teeth more susceptible to decay than those whose physical development is distinctly good? I venture to believe that there is not any distinct evidence to support this view. It must, however, be admitted that some eminent authorities consider that vitiation of the oral secretions from general ill-health is the chief predisposing cause of dental caries. I do not wish to seem to contend that vitiation of the oral secretions may not predispose to caries; I would, indeed, maintain that certain disturbances may, and do, prejudicially alter the buccal secretions. Moreover, general and prolonged ill-health tends to diminish the amount and vigour of mastication, which in itself predisposes to caries. Nevertheless, I do not contend that these predisposing causes are of any great moment when brought about by a state of imperfect development alone.

It is not only by inducing caries, however, that the teeth may be injured. Their use and their beauty may be greatly impaired by irregularity. Physical degeneration and irregularities of the teeth are necessarily intimately correlated, because the conditions which give rise to imperfect development are almost invariably associated with prolonged malnutrition and emaciation, and general emaciation is practically always associated with emaciation of the tongue. I cannot here enter into how the development of the dental arches and jaws is dependent on the

development of the tongue,\* but I have no hesitation in saying that it is a fact, and when we see an adult with irregular teeth we can tell, with something approaching absolute certainty, that he was emaciated for a considerable time during youth.

Secondly, we may consider the question whether physical degeneration may or may not be due, as a general rule, to bad teeth. To this question there seems to be but one answer. We cannot expect physical development to go on satisfactorily so long as the teeth are decaying or are otherwise diseased. How this must necessarily be so is well known to all of us: dental caries is simply an outcome of oral indigestion. The carbohydrates are not digested as they ought to be; they are neither subjected to the churning-motions of mastication nor the insalivation they require, for they are, as a rule, nowadays presented to children in a state which stimulates neither mastication nor flow of saliva. All parts of the function of digestion are necessarily intimately correlated, so that it does not surprise us that this disturbance of the first stage of digestion is very apt to upset the normal working of the stomach. Of course, if digestion does not go on satisfactorily, neither will physical development.

In addition to this we must consider the carious cavities, their contents and consequences. We can hardly imagine that the products of the numerous bacteria associated with caries can by any possibility be otherwise than detrimental.

\* This subject is fully dealt with in "The Irregularities of the Teeth with Special Reference to a Theory of Causation and the Principles of Prevention and Treatment," by J. Sim Wallace, M.D., D.Sc., L.D.S.

The harmful results of decaying teeth may also be brought about by the injury and inflammation inflicted on the gums. This might not be considered serious, were it not that the inflammation is apt to spread backwards to the throat, and thus render it susceptible to be attacked by pathogenic micro-organisms. It has at least been maintained that several diseases having a local manifestation in the throat are predisposed to by such conditions. Diseases, such as scarlet fever, diphtheria, whooping-cough, tonsillitis, etc., might be less frequently contracted if the mucous membrane of the throat had not its resistive power enfeebled by the chronic irritation and extension of inflammation engendered by decaying teeth.

Akin to these considerations is the belief that the normal bacterial flora of the mouth is inimical to pathogenic microbes, as contended by Dr. Miller and others. Whether these views are strictly accurate or not remains to be proved, but they are so much in accord with common-sense and the analogy of other cavities having a communication with the outside, that the burden of proof would appear to rest with those who might venture to question its truth.

Much has of late been written with regard to the harmful effect of swallowing the septic products of dead and suppurating roots. No doubt it is injurious to digestion, no doubt the evidence is sufficiently conclusive to warrant us in maintaining that physical development is not likely to go on satisfactorily so long as dead roots are left in the mouth. But the swallowing of septic matter is probably not the most seriously detrimental effect. It is the direct

absorption of septic matter into the blood. This condition is common and chronic. I am probably within the mark in saying that 50 per cent. of growing boys and girls of the working classes in towns, have one or more septic roots in their mouths prejudicially affecting their health. However, I do not intend to go into this subject of oral sepsis ; its importance is beginning to be a little more adequately recognised, and is the subject of another communication at this meeting. Here, however, the question arises, Does the class which is physically most degenerate really suffer more from septic roots ? To this there can be but one answer. They do. It is generally supposed, and no doubt it is true, that the upper classes are more subject to dental caries than the lower classes, but they are much more careful to have their teeth attended to. On the other hand, it is remarkable how few of the lower classes are without several septic roots.

Lastly, let us direct attention to the question whether there is anything in our surroundings or general mode of living which is prejudicial both to the teeth and to general physical well-being. I venture emphatically to submit that there is. Medical science has made such progress, we hardly dream that something may have been overlooked. Yet an investigation into the subject will prove that it is so. "What is true of science generally is likewise true of every scientific problem. Everything does not mean advance ; we often meet with a standstill, sometimes take a retrograde movement. A striking example of this is shown in the investigation of the salivary glands. After the appearance of the classical work of Mitscherlich, and

a number of talented investigators, such as Claude Bernard, Schiff, and others,\* there came a retrograde movement, and now what we read in our text-books would lead "one to suppose that the work of the salivary glands is of no import, and that they respond in haphazard fashion to every form of stimulus."†

Then, again, there is the unfortunate, though perhaps convenient, division of the process of digestion into three stages—namely, buccal, gastric, and intestinal, for, as has been so ably shown by Professor Pawlow, all stages of the process are most intimately co-ordinated.

Working from quite another standpoint I came to recognise the importance of a similar conclusion. I had been struck by the marked superiority of the teeth of those who ate the least soft and refined food, and also saw what appeared to me good evidence that those who had been brought up on, and continued to eat, natural, unrefined food, had a much better digestion than those who ate the most refined and apparently physiologically digestible food. In other words, I came to the conclusion that food which demanded efficient mastication was not only best for the teeth, but for the stomach and intestines also.

It is interesting to see how certain experimental procedures have given rise to most disastrous conclusions. Some experiments were made outside the body showing, it was supposed, how gastric digestion went on. Here was apparently unquestionable evidence set before one's eyes

\* Pawlow and Thompson, "The Work of the Digestive Glands," p. 150.

† *Ibid.*

showing digestion going on in a glass bottle. It was seen that finely-divided particles were rapidly digested, whereas the process was slower if the pieces were large. Now, nothing could have been more natural than to advocate that the food should be refined, pulverized, or ground, so that the digestive juices would be more able to deal with it. It was not anticipated that this refinement would tend to make children swallow their food with little or no mastication. Nor was it expected that by habituating the child to swallow without mastication it would contract the habit of swallowing even lumps when these at times got into its food. Nor was it imagined that the teeth thus deprived of their natural function would decay and give rise to all the troubles to which we shall refer. It was not expected that this interference with the first stage of digestion would disturb nutrition and consequent healthy development.

It was not anticipated that this disturbance of the health and nutrition of growing children would lead to a craze for more nutritious food. It was not seen that this craze for nutritious food would lead to a still further elimination of the innutritious fibre which demands mastication, and is commonly associated with natural and unprepared foods. Nor that this would appear still further to necessitate refinement of the food, and make it seem a necessary accompaniment of civilization.

All these considerations are naturally intimately associated with the physical development of the body, but they do not end here. The lowered vitality associated with weak digestion leads to susceptibility to other

diseases, one of the most interesting and common to which we may refer being adenoids. I do not here intend, however, to trace the causes of adenoids. The problem is in itself complex and would require a separate paper for its elucidation. Suffice it to say that constipation and mal-assimilation, with consequent emaciation and disturbance of the respiratory function, together with insufficient mastication and development of the tongue, predispose to irregularity of the teeth, narrow palate, narrow nasal passages, chronic colds, mouth-breathing, and adenoids.

It may be said that the pap-feeding of children is the outcome of years of practical experience, and that it might be a fatal or dangerous experiment to venture upon a new method of feeding. All possible theories may be advanced against feeding children with food which demands much mastication, but the system has already been put to the test over and over again. In many cases it has been carried out more or less by chance or by force of circumstances, but recently it has been put into deliberate practice in several parts of the kingdom, and from all I hear, with the most excellent results. I know of one child who, since he was weaned, seldom got any food which did not require a very considerable amount of mastication, and before he was three years old he sat down to his Christmas dinner, and had a liberal supply of turkey, boiled ham, greens, and potatoes, two helpings of plum pudding, some nuts, and an apple. He was not in the slightest way upset, and was happy to go through the same meal on the following day, except that the turkey was cold. Needless to say, his teeth do not show the

slightest signs of decay, although nowadays, at the age he now is, it is quite usual to find decay more or less advanced, in several teeth.

It is scarcely realized that the masticatory apparatus of a child of two to two and a half years of age is relatively very large. It is much larger than an adult's in proportion to the size of the child, and considerably larger in proportion to the amount of food consumed. Nor is the significance of these anatomical facts realized by those who advocate porridge and milk, milk pudding, and bread and milk as staple articles of a child's daily diet.

An interesting corroboration of these views is to be found in the well-known fact that children brought up in towns have generally a worse physique and worse teeth than country-bred children. This, no doubt, arises from the fact that the town-bred child has meals largely consisting of, or supplemented by, the products of pastrycooks and confectioners; while the country-bred child has meals largely consisting of, or supplemented by, the fresh and natural foodstuffs from the kitchen-garden and the orchard. It should be noticed, however, that there is no necessary connection between town life and dental caries. A class illustration of this is to be found in the fact that certain Jewish children who are brought up on food better adapted for the preservation of the teeth and body in general, have much better teeth and ampler dental arches than the equally town-bred Gentile. So, too, the growth and general physique are correspondingly better.

Another convincing corroboration of these views is to be found in a consideration of the increased prevalence of

certain diseases. In a general way it may be said that we are in less danger of disease than were our ancestors. The advances of sanitary science, the steady progress of medicine, and the control and conquest of one disease after another, together with the general increase in comfort in which we find ourselves, all tend to physical well-being and freedom from disease. But notwithstanding this general amelioration there has been an appalling increase of those very diseases which have their origin in the soft, refined, and highly nutritious foods, which stimulate the muscular activity neither of the jaws nor stomach nor intestine. Dental caries was once an almost unknown disease ; now in England, at least, it is the most prevalent of all diseases. Indigestion and constipation have become so common that they are almost looked upon as necessary concomitants of civilization. Increased mortality is caused by diarrhoea resulting from undue lodgment and consequent fermentation of food in the intestine. Appendicitis, from the lodgment of faecal or other matter which the weak or sluggish intestine is unable to pass on, is an alarmingly fashionable disease. Neurasthenia, arising from gastric and intestinal insufficiency, is now quite common, although a generation ago even the name of the disease did not exist. Adenoids have become so common that a new class of surgeons is kept busy removing them. Lastly, anaemia and rickets, presumably from malassimilation and oral sepsis have increased. Yet, in spite of these terrible facts, the nutritious pap system of feeding children is gaily advocated by intelligent and responsible physicians !

We may now say a few words with regard to the

methods by which the conditions which lead up to the deterioration of the teeth and general physique may be combated.

The inspection of school children's teeth by a qualified dental surgeon would be of much use, but my belief in the complete success of such inspection as a means of preventing dental troubles is not very great. The teeth are most liable to be attacked by caries before the child goes to school, and by the age of five many children are amply supplied with carious teeth and septic roots which seriously jeopardize development, if indeed they have not already more or less ruined the constitution. Thus it is that the natural method of combating the troubles will always remain the most important. Mothers ought to know or learn how to rear, and more especially to feed, their children. I do not seriously propose this, but I believe it will soon be seriously proposed that before a woman shall be granted a certificate of marriage she will be required to pass an examination on hygiene and dietetics. Perhaps a political agitation on the subject might have a beneficial moral effect. Unfortunately there seems to be but little organized desire on the part of the public to know how to prevent the disease, and no inducement is given to medical men to investigate the subject. Doctors and dentists are seldom consulted on how to prevent disease. They are consulted and paid for their skill in curing it, and naturally devote their best attention to that for which they are paid. Perhaps a society for the prevention of disease might do much good.

Another point of importance is the formation of healthy

ideals. At present the ideals are weak and unwholesome. A mother's intention or ideal nowadays is to avoid giving her child any food which it will be unable to digest; and so it is kept on what is essentially an infant's diet for years after it should have been able to eat practically anything. Unfortunately, this ideal is often apparently encouraged by the medical practitioner. When he is consulted with regard to digestive troubles he almost invariably tells his patient to stop eating this or that food. He seldom tells the patient how to strengthen the digestion so as to be able to eat the foods which were found to disagree. Naturally the patient wants to eat what he likes, and sometime or other does so; but nothing having been done to increase his digestive capabilities, the eating of the forbidden food leaves him worse than ever. This process of forbidding articles of diet while nothing is really done to strengthen the digestion often gets carried further and further until the miserable patient is limited to little more than breadcrumbs, boiled fish, and milk.

It should surely be realized that the process of digestion has arisen to extract nutriment from more or less in-nutritious foodstuffs, while the wholly in-nutritious part is passed along the intestine to be evacuated. The present-day belief would appear to be to take in nourishment by the mouth, and by the aid of pills render the intestine capable of extracting excrement from it.

The continual increase of highly-prepared and nutritious foods is a matter to cause grave apprehension to anyone who is convinced that it is a necessity to eat the natural foodstuffs to which the alimentary canal, from mouth to

anus, has through countless generations become adapted. Almost every day we have thrust upon our attention some new extract of beef, or some predigested or malted preparation, or some proprietary food imitating all the disadvantages of milk. It should be impressed on everyone that all these highly assimilable preparations are most dangerous, in that they are sure to leave a small residue in the intestine which is bound, sooner or later, to ferment and give rise to ptomaines and other highly poisonous products. Unless such foods are taken with a large amount of chemically inert matter, such as certain forms of cellulose, which will cause a regular, at least daily, evacuation of the bowels, they should only be taken after having had the advice both of a consulting physician and a dental surgeon.

Physical training and gymnastic exercises have been advocated as a means of preventing physical degeneration, but until the body is properly nourished, and the diseases which cause physical degeneration have been eradicated, they will be of little avail. Moreover, as it is writ large in Fletcher's collection and epitome of some valuable contributions to the subject,\* "Do right in the feeding of your body, and an irresistible desire for physical exercise will follow as a matter of course."

Above all, however, it is necessary that there should be something approaching unanimity of opinion among the members of the medical and dental professions. If doctors differ, how can we blame parents for ignorance? Many mothers are anxious to learn, and take all reasonable

\* "The A. B. Z. of our own Nutrition."

*is sure to be healthy, constructive and 5 altruistic. Such results of right living are what we want. The rest will take care of itself.*

*Horace Fletcher*

*Dr Wallace  
could not have  
chosen from my  
writings a sentence  
better calculated  
to epitomise  
my interest  
in the subject  
Energy according  
spontaneously  
from right nutrition*

trouble to do what is right, but on that very account they fall into error from following erroneous teaching. I believe I am correct in saying that there are the most fundamental differences of opinion in the dental profession as to the methods to be employed to prevent dental caries, nor is the medical profession unanimous as to the correct methods of feeding children. Some few advocate hard or fibrous food demanding mastication. Others, such as an American authority who has recently written on the subject, contend that children should be allowed nothing but soft food till the age of six, lest the teeth should be injured !

It may be said that I, at least, have little justification in urging unanimity of opinion, as but for the views advanced in my investigation into the "Cause and Prevention of Decay in Teeth" and of those few who have followed on similar lines, there is as perfect unanimity as could well be expected. Perhaps so ; but this very unanimity of opinion and consequent identity of the methods advocated and adopted, together with greater prevalence of the disease in the class which used the methods most, led me to doubt the wisdom of the procedures, and it was only after mature consideration that I ventured to make known my views.

Recent changes of opinion both in the dental and medical professions amply justify the position we have taken up. If what we read is accurate, then, indeed, a revolution would appear to have come over the dental profession. Last year Mr. Hopewell Smith said : " Ask a hundred per cent. of the members of the British Dental

Association to name the two great remedies against the initial commencement of caries of the teeth, and all with one voice will exclaim, 'The use of the tooth-brush and the use of antiseptic mouth-washes.'" This year we read in the *Dental Annual* that "interest has been aroused by iconoclastic opinions ventilated in medical periodicals as to the efficacy of tooth-powders and the artificial operation of brushing the teeth and gums. There has been a remarkable consensus of opinion as to the superiority of early mastication, the use of hard and resisting food, and the general exercise of the jaw muscles . . . as compared with soft feeding and artificial cleansing."

I doubt if converts to a new truth are so speedily got unless both the older beliefs are hopelessly insufficient, and the new ones are obviously in accord with known facts.

Surely the time has come when we might advocate something which would really prevent caries of the teeth and those other diseases which are at present doing so much to ruin the national physique. We must not be misled or discouraged by those who in spite of the most convincing evidence, still maintain that "the cause of the prevalence of dental caries has yet to be discovered." Dental caries is preventable, and we know enough to explain how this may easily be done. We know also quite enough of the physiology of digestion to warrant us in condemning the pap system of feeding children.\*

In conclusion I would remind you that it is not only a dental question, it is not only a medical question, it is not

\* "Observations on Mastication," by Harry Campbell (*Lancet*, July, 11, 18, 25, and August 8, 1903).

only a national question, but it is probably the most important of all questions affecting the physical well-being of humanity throughout the length and breadth of the civilized world. It may be urged that the civilized world may not follow our principles, and the success which otherwise might have been achieved will not be got. It may not be possible for us to make the deaf hear or the dull appreciate, yet a system which allows a more liberal, a more varied, and a more natural if less nutritious diet, may at least be acceptable to the great majority.

Certainly I believe we can and will do much to prevent the increase of dental caries, and those diseases of kindred origin to which we have referred ; but if " 'tis not in mortals to command success, we can do more, we can deserve it."

## CHAPTER VII.

### COMMENT ON PHYSICAL DEGENERATION IN RELATION TO THE TEETH.

THE attractiveness of the title, or the general interest taken in the subject caused the foregoing paper to be abstracted and commented upon in a great number of journals. On most of these criticisms I do not intend to make any comment, but one or two which suggested that physicians would probably have good reason for upholding the system of feeding which I attempted to condemn, compel me to quote somewhat fully a leading article in the *Medical Press* :

“ A paper was read by Dr. Sim Wallace at the recent annual meeting of the British Dental Association at Aberdeen, on the connection between physical degeneration and dental caries, in which an original line of reasoning was followed with the object of showing that it is to the food of the people that their dental troubles must be attributed. Without committing ourselves to Dr. Sim Wallace’s conclusions, we may say that his paper was suggestive, and deserves to be well pondered. He began by pointing out that there is no evidence that the ill-developed classes of society have teeth more susceptible to decay than those of good physical development, but that

admittedly conditions of malnutrition and emaciation act prejudicially to the proper growth of the teeth. So long as the teeth are defective it is hopeless to expect physical development to go on satisfactorily. The two developments are intimately correlated. He then dealt with the evils resulting from infected cavities in the teeth, and from vitiation of the oral secretions by the products of bacterial action, and showed that much as these undoubtedly lowered the resistance of the mouth and throat to disease onslaughts, an even more serious result is the chronic absorption into the blood of septic matter. In these ways the lower classes, even though they set out better equipped dentally than their superiors, suffer greater impairment of health, for they are far less careful of their mouths than their more fortunately circumstanced fellows. But the most interesting part of Dr. Wallace's paper was that which discussed the cause of the modern inferiority of teeth to those of our forebears. Dr. Wallace had often been struck by the superior quality of the teeth of those who ate the least soft and refined food, and by the fact that such people possessed better digestions than those brought up on refined and apparently physiologically digestible food. It is his deliberate opinion that food demanding thorough mastication in the mouth is not only best for the teeth, but for the stomach and intestines also, and that the early decay of teeth and the sluggish action of the alimentary canal, which is evidenced by indigestion and constipation, are the direct outcome of the habit of eating refined, soft food. Such foods allow the function of mastication to fall into desuetude, and the

child, when he finds a lump in his food, falls into the habit of swallowing it whole; the teeth decay, and the digestive functions become perverted. All these circumstances lead to a demand for still softer and more nutritious foods, and the evils are perpetuated in geometrical progression. Dr. Sim Wallace is prepared to attribute to this unnatural tendency not only dental caries, but also diseases such as appendicitis, rickets, neurasthenia, adenoids, and anaemia. We are inclined to agree with him that the preparation and quality of food used at the present day are some of those circumstances of civilization that operate differently to what have been expected. It is a well-known fact that the physiologically perfect products of the laboratory combined in theoretically perfect quantities frequently fail to nourish those to whom they are administered, whilst natural foods that contain much that appears unnecessary and harmful, agree well. No one can regard with pleasure the consumption, now so fashionable, of artificial, concentrated food products, and it is quite possible that the indigestible parts of natural food may have a useful function to perform in the economy. One of these functions may certainly be that of keeping the teeth in healthy order, and, if this be so, while the present dietetic arrangements in the community persist, it is not likely that any amelioration in the teeth of the race will take place. Evidence telling in favour of Dr. Sim Wallace's theory should be eagerly sought, for there must be a good deal capable of being brought

forward if it be the true one. At any rate, the whole subject is one of so much moment that no efforts to ascertain the facts should be neglected. Dental caries has been lightly regarded far too long ; it is now assuming dimensions that are more or less alarming."

## CHAPTER VIII.

### SPECULATIONS AND SUGGESTIONS.

A MIXED meal is generally regarded as physiologically correct, and there is no doubt that certain combinations are distinctly advantageous while the separate component parts may be actually harmful. Thus sugar, cellulose, vegetable acids and bitter principles, combined as they are in many fruits, are admittedly beneficial, while each one separately may be actually harmful if indulged in freely. Most vegetable foods, especially fruits, very generally associate cellulose, sugars, acids, and acrid principles, and it is scarcely right to consider the effects of any one of them when dissociated from the others. They naturally supplement each other. Thus, while the cellulose, on account of its physical nature is arrested in the mouth, and disintegrated by the teeth, the acid and acrid principles stimulate the flow of saliva and help to loosen the cellulose framework. Further, the acrid taste often remains in the mouth and continues to stimulate the flow of saliva even after the food has been swallowed. Then, again, the sugars stimulate the secretion of saliva. The mucous glands are likewise stimulated, and so the cellulose, and even any ligneous shreds which may accompany it, are coated with mucus and rendered fit for passage

along the alimentary canal. Moreover, this copious secretion of saliva helps the more thoroughly to convert the starch and sugars, and the prolongation of the stage of alkaline digestion in the stomach has a certain importance in further disintegrating cellulose.

It is not only on account of the effect on the cellulose that I would refer to the collateral benefits of bitter and acrid tastes. I would refer to them because the orthodox habit of giving young children almost nothing but soft, bland, generally alkaline food has disastrous effects that are never dreamt of. Thus, being for prolonged periods deprived of these bitter and acrid substances, when opportunity affords, children very generally over-indulge in quite unripe and acrid fruits or acid drinks. If, however, the taste for bitter principles is allowed, or, better, gradually stimulated to develop, then such excesses are not indulged in. Similarly, a liberal supply of fresh ripe fruit helps to prevent the craving for, and excessive indulgence in, sugar or sweets. At first, strongly acrid flavours, generally and advantageously, act as deterrents in the selection of foods, but by experiment and by following the example of the parents, the taste for these bitter principles becomes largely acquired. Frequent association of acrid with irritant principles, however, has naturally prevented a pronounced development of the instinct for bitter principles, which, when fully developed, is somewhat antagonistic to the desire for sweets. The supply of sugar which was available for our ancestors was very limited, and therefore prevented an excessive indulgence in it however strong the craving for it became.

It is important to recognise this fact, not because the ruin of the teeth gives rise to many more serious troubles, nor because the injury to the teeth means ruin to the power to digest and relish some of the most luscious foods, but because it has become the fashion to belaud the dietetic value of sugar and to look upon it as an important food, while in reality it should be sparingly used and regarded rather as a condiment. What does it matter whether we can turn sugar into so many units of energy, if at the same time it ruins the teeth and irritates the stomach to such an extent that healthy and vigorous digestion is lost?

It is just possible that the considerable exclusion of fruit and vegetable juices, together with the sugar, aromatic, acid and bitter principles which they contain, may give rise to an excessive indulgence in alcohol. In European countries, at least, where fruits are most freely consumed, drunkenness is rare, whereas in countries in which fruit is not freely consumed, and more especially in those countries in which the cereal and animal foods form a large part of the daily dietary, excessive indulgence in drink is much more frequent. Even in England the amount of drunkenness is markedly low in fruit-growing counties such as Kent and Devon, whereas in Northumberland, especially in mining districts where the vegetable food is almost solely of a cereal nature, drunkenness is particularly common. Another factor which may possibly prevent fruit-eating people from an undue craving for an alcoholic stimulant, is to be found in the fact that fresh vegetable food, when thoroughly

masticated, gives rise to a feeling of activity, whereas a meat meal tends to give rise to a feeling of lassitude, and an alcoholic stimulant may then be naturally desired to counteract the feeling.

In precibicultural times man had to subsist upon what he could find, and as the vegetable substances were not of a highly nutritious nature, it was necessary for him to be continually in search of food when only vegetable products were available. No doubt those in whom a vegetable diet produced a feeling of energy survived, for such a diet required of them almost continuous activity. This forms a contrast with the effect produced by a large meat meal; for following this the most beneficial state is one of repose, in which the ample supply of albuminous nutriment may most readily and quickly be utilized in the rebuilding of the tissues. In all parts of the world and at all times it seems to have been the custom for adults to increase the energetic feeling by the consumption of various vegetable extracts or stimulants of various descriptions, and under the conditions which we have suggested, the beneficence of such stimulants may be recognised. If this be so the desire for stimulants cannot be regarded as an accident or as a by-product of evolution, but rather as a beneficent instinct under certain environmental and dietetic conditions. Without saying more at present, it may be noted that the origin and cause of such cravings suggest that they might be mitigated by certain dietetic changes. Firstly, in the adoption of a less highly nutritious diet, whether of an animal or of a cereal nature. Parti-

cularly an avoidance in the routine dietary of those highly nutritious foods which are found to produce a feeling of lassitude. Secondly, in a more liberal supply of acid fruits, of bitter, pungent, and stimulating principles, and in general a more careful appreciation of the value of condiments, not only in the diet of adults, but even in the diet of children.

I would also advocate another form of mixed meal, namely one in which the food contained a large amount of solid matter, stimulating or demanding ample mastication. The reasons for this are so obvious that one wonders why it has become possible for physicians to advocate the giving of bread well soaked in milk to young children. Perhaps it is advocated so that the clot formed of the curded milk may be broken up and one of the disadvantages of milk avoided, but it is doubtful if the present-day maxim of milk at any cost justifies the deluging of children's stomachs with unconverted starch.

The recommendation in otherwise excellent treatises of a diet consisting almost wholly of "bread well soaked" in milk and the like,\* shows a complete disregard not only of the physiology of mastication, but also the whole of that important part of digestion which takes place in the mouth. Meat, fish, and poultry, tender or otherwise, according to the age and capabilities of the stomach, should be given in large pieces cut thin. Flat pieces about one inch square generally *necessitate* a certain amount of mastication. It is difficult to swallow large flat pieces of meat without mastication, but when finely

\* "Food and the Principles of Dietetics," Hutchinson, p. 457.

minced, little or no mastication is called forth. With young or delicate children the most tender meat may be given, and in order to have it specially easily digestible, yet of a consistency necessitating mastication, it may be given more or less raw. If the child tends to swallow without mastication, cut the thin pieces *larger*. Only in extreme cases is the giving of raw meat juice a necessity, and then it should only be a temporary expedient. The harmfulness of inefficient mastication as regards gastric digestion has long been recognised, and, curiously enough, in order to make things right, food, at least for children, is generally practically masticated before introduction into the mouth, but to my mind this only augments the cause of the evil for which it is intended to make amends. In other words, this preparation of food as exemplified, for example, in minced meat, or gravy and mashed potatoes, only further induces the child never to acquire the habit of mastication.

This is not all. The physiology of digestion is not a piecemeal business. All parts of the process are intimately co-ordinated. To illustrate this fact, which physiologists have not fully appreciated until recently, we may mention that if the œsophagus of a dog is cut, and arranged in such a way that food swallowed is passed out at the cut end instead of passing into the stomach, the psychic effect caused by the mastication of the food, produces a very considerable flow of gastric juice, definite in amount. The entrance of food into the stomach, too, causes a definite amount of gastric juice to be secreted. Food introduced into the stomach unaccompanied by mastication

tion and concomitant psychic effect, only stimulates a partial secretion of the gastric juice.\*

Then, too, the amount of saliva secreted has its effect on gastric digestion. Not only does it promote the digestion of starch in the early stages of its lodgment in the stomach, but probably the permeation of the proteid with the alkaline saliva renders such food more subject to the ingress of the gastric juice. The saliva does not contain mucus, carbonate and phosphate of soda, etc., for idle purposes. Perhaps our semi-atrophied salivary glands may predispose to indigestion. I have heard that the alkali in the masticated food allows the propepsin secreted by the gastric glands to permeate the food, and form pepsin in the substance of the food in the nascent and therefore most active condition. However, to administer to children with teeth, food which does not require mastication, is to ignore a primary fundamental and important stage of digestion. This point need not be elaborated, for it is hardly necessary to insist upon the fact that good digestion waits not only on appetite but on mastication, and if we swallow food without mastication active digestion is not stimulated, and the seeds are sown of indigestion, irregularities and caries of the teeth, appendicitis, etc.

The impoverished and decreasing power of lactation with which the modern mother is afflicted is no doubt the result of a weak and impoverished digestion, but this does not require to be dwelt upon. It is only necessary to glance at the dental armamentarium and observe the

\* "The Work of the Digestive Glands," Pawlow and Thompson, Chapter IV.

deranged positions of what teeth remain, not to speak of the diseases which may probably be progressing, to observe the legacy which modern dietetics has bequeathed to her. This is, of course, only an index of the general derangement of the entire length of the alimentary canal.

Akin to these considerations is the fact, lamented alike by the medical profession and all those who have the welfare of the nation at heart, that there is a progressive increase of sterility.

The causes of sterility are well known; impaired nutrition, with local manifestations either associated with derangements of secretions or with certain displacements, is responsible for much, and the latter often defeats the object devoutly to be wished even though impregnation has taken place. Lastly it should be mentioned that artificial sterility is connected in perhaps the majority of cases with circumstances which we can readily understand. It is well known that the child-bearing period involves a considerable and perhaps usually a very severe strain upon the healthy mother; what then must it be to one with a weak digestion and impoverished health, the result of dietetic errors commenced early and continued more or less throughout the whole of life? If in addition to this we contemplate the "time" these delicate mothers have with an ill nourished child, reared on foods which are a constant source of trouble, we may grant at least that there are extenuating circumstances. Moreover it should be remembered that the instincts and concomitant gratifications of maternity may be perverted by weak health and impaired nutrition, for the demands are of a

material nature, and correspondingly require a healthy body and a thoroughly efficient digestive apparatus, while those who have a weak digestion and weak health are more likely to be satisfied by gossip and light literature, which tax the material output much less severely.

The value of milk in the diet of children is at the present day largely overestimated, and it should be distinctly recognised that it is an extremely unnatural food for children over about the age of two years. It is a form of food which does not even approximately resemble any of the foods to which the alimentary canal of children, with twenty functional teeth, has through thousands of generations become adapted, and it will not surprise us if a consideration of the effects of a milk diet leads us to deprecate its continuance.

“ Being a complete food, milk may form an exclusive diet, a purpose for which it is frequently employed, as in the systematic treatment of renal affections. In a person thus nourished one frequently finds the tongue coated, the breath foul, and a condition of habitual constipation. The diet makes no demand on the functional activity of the muscles of mastication nor on the salivary, lingual, and mucous glands ; moreover, apart from the absence of stimulus to secretion, the mucous surfaces become lined with a thin film of milk, which blocks their orifices, and forms a nidus for the growth of saprophytes. Hence a foul mouth, coated tongue, and acidity, betraying functional inactivity and initiating structural decay. The liquid meal pours into the stomach unheralded by nervous reflex and unmingled with stimulating salivary secretion.

Consequently no preparation has been made for its reception, its visit is unexpected, and its behaviour renders its presence unwelcome. The liquid garb of innocence is discarded and discloses masses of solid curd, difficult of access to the gastric juices, causing an irritative flow of mucus and affording a soil favourable to the growth of a varied pathogenic flora. The fermenting mass of curd struggles through the pyloric orifice, disturbs the hepatic function, irritates the bowel, evolves gases and refuses to move on without the aid of mercurial or saline purgation ; in a word, it acts the part of the rabid and iconoclastic social reformer.

“ Such is often the effect of whole liquid milk taken as an exclusive food. Now, however, it is rarely given without dilution or admixture with other ingredients which serve to break up the curd or otherwise prepare it for absorption. But in whatever form taken liquid milk retains the essential disadvantages of liquid foods in general—viz., that it passes direct to the stomach without making any demand on the complex mechanico-physiological processes of mastication.”\*

This quotation refers to pure, fresh milk, uncontaminated with the various foul products for which it is well known to have special affinity. The cows themselves may be diseased, thus tuberculosis in dairy-fed cattle is extremely prevalent ; “ due to these factors, overcrowding, absolutely inadequate ventilation and want of sunlight and exercise. The disease occurs in 20 to 40 per cent. of such animals. . . . Apart from the condition of the animals,

\* Stuart Tidey, M.D., (*Lancet* December 17, 1904).

the method by which the milk is collected is utterly insanitary. Absence of any attempt to groom the cows, or to remove the hardened faeces which encrust their flanks, absence of any facilities for the milkers cleansing their hands or wearing clean overalls, and finally, the fact that on the same employé devolves the duty of cleansing the byre as well as milking the kine. These considerations lead one to be surprised, not at the filth the milk contains, but at the fact that it does not contain more."\*

When we consider this state of affairs we are not surprised to learn "that during the sufferings and starvation connected with the Siege of Paris in 1870-71, while the general mortality was double, that of infants was said to have been reduced by about 40 per cent., owing to mothers being obliged to suckle their infants." The same increase of adult and diminution of infantile mortality was seen during the Lancashire Cotton Famine, when Newsholme notes "mothers were not at the mills." It cannot be doubted that if cow's milk were totally unprocurable for infants and children the death-rate would be largely decreased. But notwithstanding this it may be granted that under certain stringent regulations, honestly and intelligently carried out, and under certain conditions, cow's milk may be advantageously supplied to children for a time. It should, however, be distinctly observed that the administration of milk, or a milk-soaked diet to children with twenty teeth, shows as much regard for the anatomical

\* "The Milk Supply of Edinburgh: With Suggestions for its More Stringent Control," by Aitcheson Robertson, M.D. Edin. Read before the Edinburgh Medico-Chirurgical Society, January 18, 1905.

and physiological requirements of the child, as would the administration of potatoes and mutton, with or without milk, to the toothless infant.

It is not only the milk-soaked diet and pap-feeding which is recommended for children that we object to, but the number and arrangement of the meals. What, for example, could be more disastrous to a child's teeth than "a little milk and a plain biscuit, or a piece of bread and butter" \* at bed-time? This, be it observed, is preceded by a meal at 4.30 p.m. consisting of "cocoa or milk with bread and butter or a stale sponge cake." Further comment is unnecessary. It may be asked what would you substitute for the recognised practices? The anatomical, physiological, and instinctive peculiarities of the child furnish us with an easily recognised guide to their correct feeding. At about the seventh or eighth month the incisor teeth cut the gum. This is accompanied by an increased secretion of saliva and a desire on the part of the child to gnaw. Theoretically on the eruption of incisor teeth it should be given some more or less nutritious vegetable, such as sugar-cane, to gnaw and suck, and thus supplement the milk diet which at this age decreases in strength and amount. Practically it may be given a stale crust to "cut its teeth upon," or, perhaps better, a small uncut bread roll, preferably cigar-shaped. This should be supplemented by fruit juice. Another imitation of the theoretically correct method of introducing infants with incisor teeth to solid food may be made by giving them a little fruit juice or the pulp of grapes, and allowing

\* Chavasse's "Advice to a Mother," 15th edition, p. 148.

them to satisfy their sucking and gnawing propensities on some such substance as leather or indiarubber. The fruit juices are beneficial and so also is the gnawing and sucking, moreover, as the physiological requirements of children are unprovided for in the present generation, it is impossible always to procure fresh sugar-cane and fruit which can be gnawed and from which the juices can be sucked. I mention this method not as a counsel of perfection, but rather to show that certain customs which are somewhat prevalent, approach more nearly to what is, in my opinion, theoretically correct, than are the principles and practices of our modern authorities on dietetics. As the teeth increase in number so must the amount of food which it is allowed to gnaw and suck. When about the fourteenth month the molar teeth come into position the gnawing and sucking must give way to, or rather be supplemented by, true mastication. At this age, then, toasted bread and butter from which the crust has not been removed, or rusks, may be given, and as the solid food is increased so proportionately should the milk be diluted, or even at this age be superseded more or less fully by water.

It should be recognised that solid food when first given to children should be distinctly different in consistency from the liquid food to which they were previously accustomed, so that at an early age they may come to recognise the difference between solid and liquid food and to treat it accordingly. If this is done, the choking and spluttering which is such a frequent result of giving more or less soaked food to children is obviated.

After the eruption of the incisor teeth the milk should

be more and more diluted till the eruption of the molar teeth, and when these have come into full functional activity, the milk, if it is cow's milk, ought always to be boiled and used rather to flavour the water, if it is used at all, than as a source of nutriment. With the increase of solid food requiring longer to digest, the intervals between the meals should, of course, be correspondingly lengthened. At the age of two years, or at most, two years and a half, only three meals daily should be allowed. While this ought to be a strict rule, the drinking of water between meals should be allowed. At an early age, certainly after the eruption of the first temporary molars, there should be sufficient variety in the meals of the child to allow of the arranging of the menu ; thus the toast and butter or cereal food, whether taken alone or with a small amount of light animal food, together with simply boiled green vegetables, should be followed by fresh fruit, sugar-cane, or, at least, fruit juice. Should sweets or bonbons be allowed they must in all cases be followed by fresh fruit.

When we recognise the philosophy of the natural methods advocated, we see that everything seems to link up with charming simplicity. Thus when there are no teeth the child should have no solid food, and its instinct to suck should be allowed gratification at its mother's breast; when the front teeth appear, together with the instinct to gnaw, it should be allowed to gnaw as well as to suck ; when the first molar teeth appear it should be allowed to supplement the gnawing and sucking and to use them to grind or masticate its food. When it gets its second molars it should be allowed to bite off its food

with its front teeth and masticate it with its molars, for it has a complete set of teeth and they are there to be used. Nothing could be simpler, nothing could be more easily learned both by mother and child, and nothing could, I believe, be more excellently arranged for the transition from a milk diet to the natural foods for which the human organism is so well adapted.

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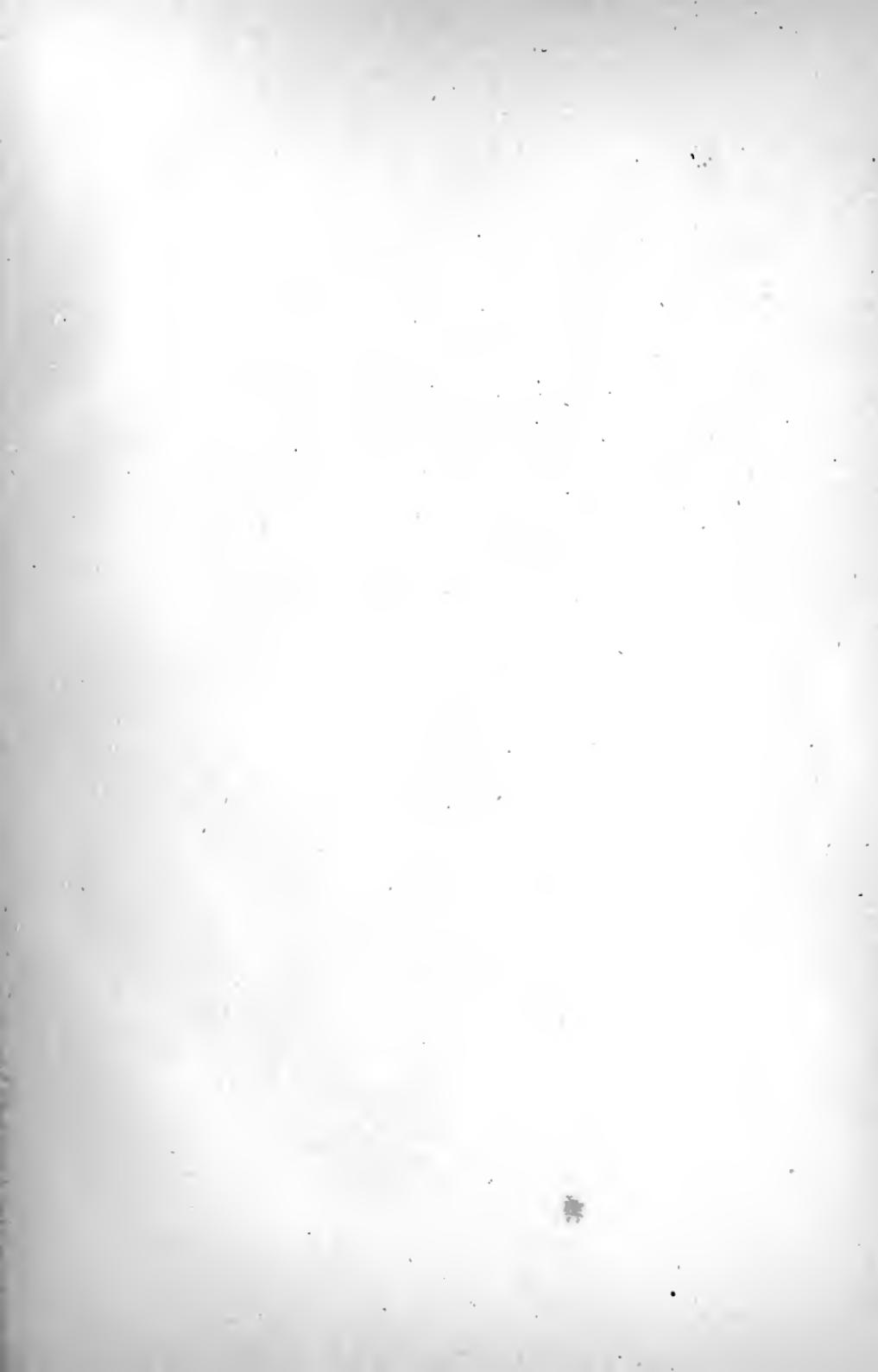
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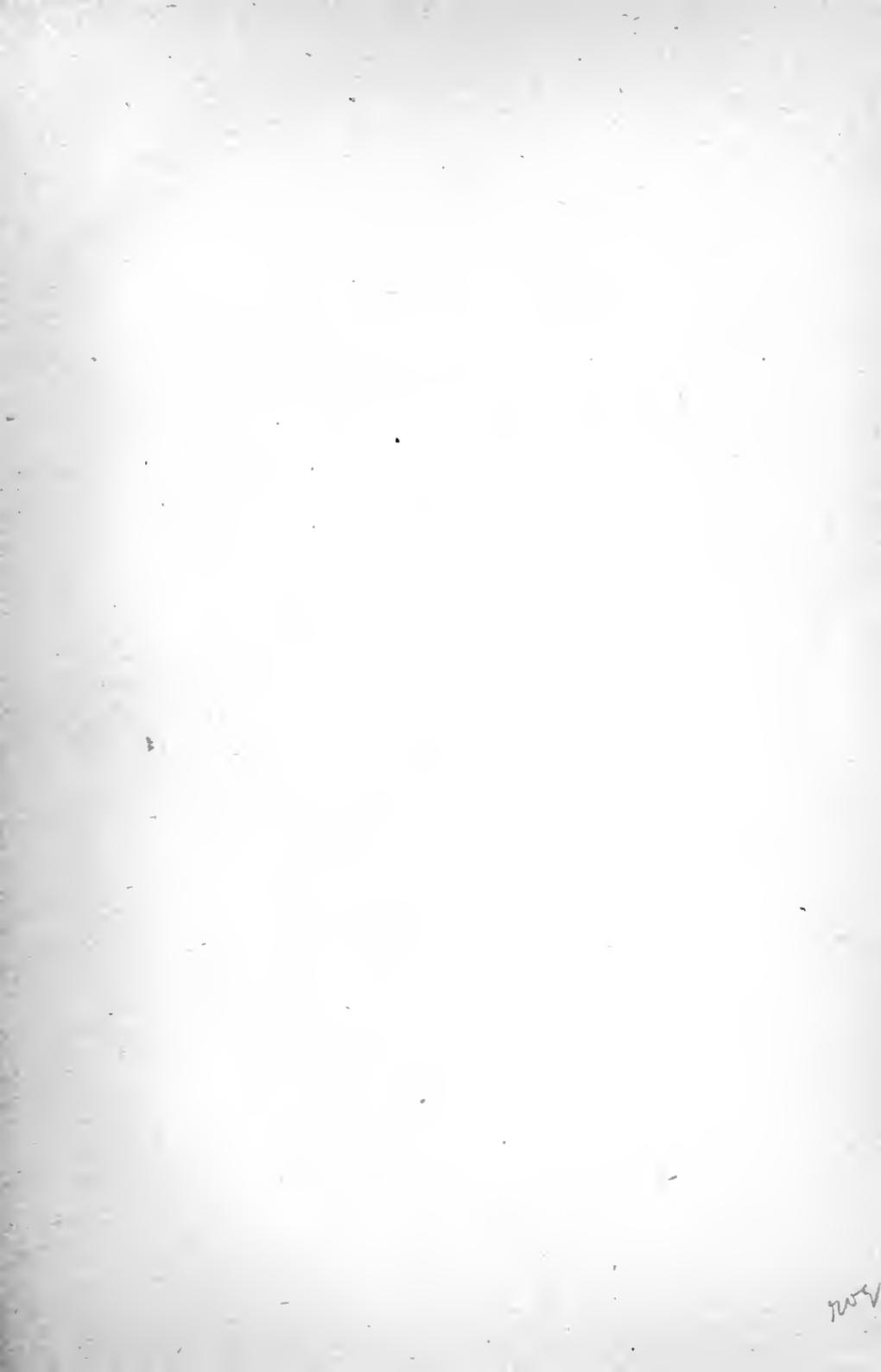
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